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VOL. XI. NEW YORK, JAN. 7, 1888. No. 1.

LOOKING around on the great and even marvelous development of the modern applications of electricity, and upon the splendid record of 1887 in particular, one is apt to ponder a little on the causes that have had the most influence in bringing about this growth. Each of us will have some special reason to assign, according to his own habit of thought or line of occupation. The pure scientist, ever seeking new truth with no ulterior motive, will have his theory about it. The inventor will feel that it was at least his genius that gave mankind new arts, new tools, new comforts. The busy financier and active "captain of industry" knows that it was his nerve, brain and enterprise which equipped and carried out the novel undertakings, and brought them to prosperity through years of trial and anxiety. All these have contributed to the great triumphs of modern electricity, and the very fact that there is unlimited work and opportunity for all, gives the science its peculiar and unrivaled fascination to day. Finality is about the last word that anybody expects to hear in the domain of electric discovery and usefulness, and the chief difficulty lies in marking the rate of progress and marshaling the latest creations in their proper relation of perspective to the future and the past. It is here that the mission of the electrical journal is made manifest, and it is in exact accordance with its discharge of duties and responsibilities that such a paper finds its position and appreciation. Aware of many shortcomings and imperfections, but strong in the consciousness that our endeavor has always been the true and the right one, we commit THE ELECTRICAL WORLD this year once again to the pursuance of its old work of furthering the common good and promoting the welfare of every electrical industry and institution. We feel that the part to be played by electrical journalism in advocating legitimate electrical interests, performing pioneer tasks of advocacy, and recording daily achievement in the laboratory or the workshop is no small one, but worthy of entire devotion; and we trust that in this respect what we do will "better what is done." The manner in which THE ELECTRICAL WORLD keeps abreast of all that is freshest in electrical work is familiar to our readers. It is our intention that, as heretofore, it shall be foremost among the agencies that cultivate and enlarge the field of electricity.

IT comes as a pertinent and timely comment on the patent reform movement in this country that Germany has made up her mind to establish a distinct court for patent, trademark and copyright cases. As this is one of the main ends now striven for, and was advocated in Mr. Arthur Steuart's recent able paper, advanced thought, here and abroad, on these subjects, is evidently working along the same lines.

WE present this week another method of obtaining thermo-electric currents, devised by Mr. E. G. Acheson. It involves several novel features, quite different from those described before. In considering the progress in thermo-electricity made during the last year, we drew attention to the fact, in our last issue, that early in the year two foreign experimenters had shown that if a thin slip of metal be placed in a magnetic field with its ends at different temperatures a difference of potential is set up between the two opposite sides of the metal slip. Mr. Acheson employs an analogous principle, but instead of keeping the magnetic field surrounding the heated conductor constant, means are provided for continually varying the strength of the field so as to produce magnetic whirls. The question arises, however, if currents could not be so generated, even without the presence of heat, for there would appear to be in this case a magneto-electric action also involved, which may be intensified by the thermo-electric action, or *vice versa*.

NOW that copper, which is so largely used in electrical work, has reached its present price, inquiry has naturally arisen as to the extent to which production can and will be increased. Our contemporary, *Iron Age*, a leading authority on these questions, taking a careful survey of the situation, remarks: "On the whole, production of copper is not so elastic as many might be inclined to believe. The product will certainly increase quite rapidly, but the amounts thrown upon the market by mines which have been idle for years will be small for six months to come. We look for the principal increase from those producers who have found 10 to 12 cents above the cost at which they could deliver the metal into consumers' hands." In other words, the return to normal values will be slow. We are a little interested to see what effect the higher price of copper is going to have in causing resort, where possible, to other metals that are cheaper but are of less conductivity. The situation is certainly one that gives emphasis to the claims of superior economy made for the alternating system, and will encourage generally the use of higher potentials.

IT may seem strange, yet it is probably true, that few establishments building power machinery, more especially prime-movers, are adequately equipped with apparatus for measuring the power absorbed or transmitted by the machine, as the case may be. The majority of electric light and motor factories appear to be no exception to this rule, and as a consequence it sometimes happens that errors are made, based upon a wrong estimate of power required or developed. But there is no good reason why this state of affairs should longer continue, as power-measuring devices can now be bought in the open market, by means of which sufficiently accurate results can be arrived at. A simple transmitting dynamometer which can be constructed at a small cost and meets many necessities is described in another column by Mr. S. S. Wheeler. It requires only one reading, that of the spring scale, being taken in connection with the speed of the transmitting belt. As Mr. Wheeler states, this simple form of dynamometer, while not permitting the highest degree of accuracy, is sufficiently reliable for general shop measurements.

SOME very interesting figures have just been published with regard to the use of the telephone in 16 of the largest towns and cities in the United Kingdom. From these returns it appears that London has 4,200 telephones in use Glasgow, 1,472; Liverpool, 1,399; Manchester and Salford, 1,293. These are the only places in which the number runs above 1,000, and the nearest to them is Dundee, with 623. It is not easy to understand why Aberdeen, with a population of 105,000, should have 521 telephones in use, or one more than Birmingham, with a population of 500,000, as the difference in rates is inconsiderable. Speaking of rates, it is well to note that in three of the places mentioned, London, Liverpool and Manchester, the tariff is $100 a year; that in six others it is $75 a year, and in six others $50 a year. In view of the difference between general prices in England and America, and of the fact that most of the exchanges in American cities are too large for fair comparison with those in the list referred to, it appears once more that the rates charged in this country are in no way unreasonable or extortionate. The probability is that if the number of daily connections could be given, it would be found that the rates are on the whole about the same here as in England. Last week we drew attention to the fact that there were at least as many telephones in use in New York as in all Italy, and this table brings out the fact that there are about twice as many here as in London, although the population of that city is certainly three times as great as that of New York

AMONG the most difficult things to explain to a student are theories of the action of the natural forces. With the exception of gravity they are characterized generally as "modes of motion," and this explanation is in various ways applied to the theories of heat, light and electricity. But to bring vividly before the eye of the student the method by which the effect of a force is propagated, recourse is frequently had to apparatus embodying mechanical analogies, and in the case of electric potential and current especially, the analogy of the difference of pressure in an hydraulic system is frequently employed. This analogy, however, while it may answer for a rough description of the general action, is lacking in accuracy in so far that it leaves out of consideration entirely the molecular action which presumably accompanies every electrical phenomenon. To explain the latter, therefore, the hydraulic analogy fails. Probably the best hypothesis in this respect is that propounded by Grotthuss early in the century to explain the phenomena of electrolytic action, in which it is assumed that under the influence of an electromotive force, the molcules, being free to move, arrange themselves in regular order, so that the like atoms of each molecule point in the same direction. This theory has been carried out further by Clausius and others, but has been chiefly confined to the explanation of the phenomena of electrolysis. In the "molecularium" of Mr. Emile Berliner, described in another column, a somewhat similar hypothesis is adopted to explain the action by which an electric current is propagated in a solid or circuit. It will be noted there that the assumption is made that the molecules of a solid have a certain freedom of motion, similar to those of a liquid, but in a lesser degree; and with this as a basis the various phenomena of static and dynamic electricity are quite fairly demonstrated graphically. But there is one point in this hypothesis which seems to be at variance with some preconceived ideas regarding the molecular difference between solids and liquids. In the latter the molecules are supposed to have a free motion among themselves, whereas in solids they are bound to each other with various degrees of firmness. Now Mr. Berliner assumes that the various angles of rotation represent the various electromotive forces possible, and that the molecular resistance to rotation represents the specific electrical resistance. According to this statement, therefore, liquids, whose molecules are assumed to be in loose connection with each other, ought to be far better conductors than the metals, for instance, whose molecules are far more rigidly connected, and therefore less easily rotated. But as a matter of fact we know that the electrical resistance of liquids is greater than that of the metallic solids, so that there seems to be a discrepancy here. But, on the other hand, it may be argued in favor of Mr. Berliner's hypothesis that the relative proximities of the molecules of bodies in the various states of aggregation also enter into consideration as a factor, and that electrical resistance may to a certain extent depend upon the distance between the separate molecules. On that assumption the increased electrical resistance of liquids over that of some solids might therefore be explained. Still another reason for this effect in support of the hypothesis might be found in the counter-electromotive force set up in liquids when current is passed through them. Altogether a careful study of Mr. Berliner's highly ingenious molecularium cannot fail to bring out many suggestions which will aid in fixing ideas regarding the nature of electricity.

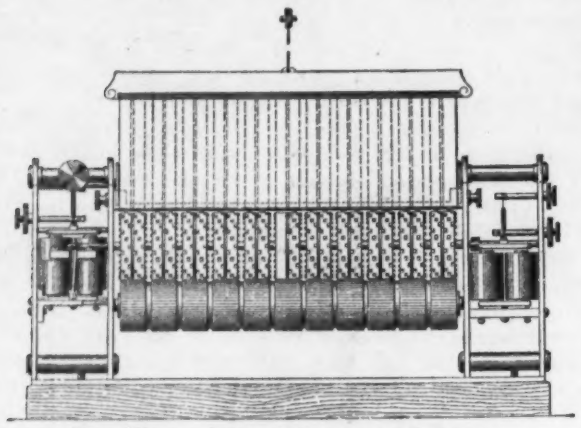
A New Departure in Printing Telegraphs.

Up to the present time printing telegraphs have been substantially confined to two classes, both using a narrow strip of paper, on which the quotations are printed lengthwise the paper. The early style had a single type wheel, printing the quotation, symbol and price in a single line, thus:

LS. 94⅛ CS. 55⅜ RT. 22¼ PR. 53¾.

This form of instrument was largely used for a number of years prior to 1870 in quoting stocks, grain, etc., but it did not fully supply the want, as it was very difficult to consult, particularly if the market was active, and the fluctuations rapid and frequent.

Later on the two-wheel instruments were introduced, which printed like the one wheel, lengthwise of the paper, but in two lines, the upper line being used for the symbol of the stock, and the lower line for the prices and amount of sales. The printed impression in the upper line is followed by a space, which is used in the lower line for printing the price, thus:



THE WILEY STOCK QUOTATION PRINTER.

DL.	OT.	N.	PR.	DH.
126½	20¾	14⅞	40⅛	102¾

This two-wheel form proved to be much more satisfactory, because the fluctuation and dealing in any particular stock could be readily examined by simply running the eye along the upper line of printing and picking out the symbol of the desired stock with the quoted price in the lower line.

But experience seems to show that even this improved style of two-wheeled instruments is not entirely satisfactory, since, in an active day's business on the market, hundreds of yards of this narrow strip of quotations are reeled off from the machine into baskets, and the tape becomes so voluminous after an hour or two as to prevent examination with any degree of satisfaction.

To avoid this another departure, supposed to have had its origin in the "bucket shops," was made. A long blackboard was used, divided by lines into perpendicular columns, each column being set apart for any given stock, the symbol of which is placed at its head. The quotations received by an operator from an ordinary Morse sounder are either chalked up on the board or indicated on a card placed in a sort of pocket or little frame in the proper column.

In this way operators could sit in chairs as an audience and watch the quotations coming over the sounder as they are "chalked up." This method has so many advantages that stock-brokers, who are men not slow to seize upon any advantage for their private offices, soon began to employ the same method, so that many of such "bucket shop" boards, as they are called, can be found in this city in the offices of regular stock-brokers. But this board has its disadvantage. It requires a larger amount of office room and some one constantly in attendance to do the work, and at the end of each day all it has accomplished is destroyed.

The invention of Mr. C. J. Wiley, of Brooklyn, which we illustrate, appears to accomplish all that can be done by the "bucket shop" board, and does it from a central station over an ordinary circuit of telegraph wires, without any attention at the broker's office other than the occasional winding such as most of the printing telegraph machines now receive.

As will be seen, the instrument consists of a series of type wheels mounted upon a shaft, each type wheel being used to print the quotations of its own stock, the printing being done upon one broad band or sheet of paper, upon which the quotations appear in columns side by side, with the name of the stock indicated at the head of each column. The symbol of the commodity is affixed to a signboard connected with the sheet of paper. The type wheels are rigidly attached to a shaft, which is revolved by a spring or weight and controlled by a suitable transmitter.

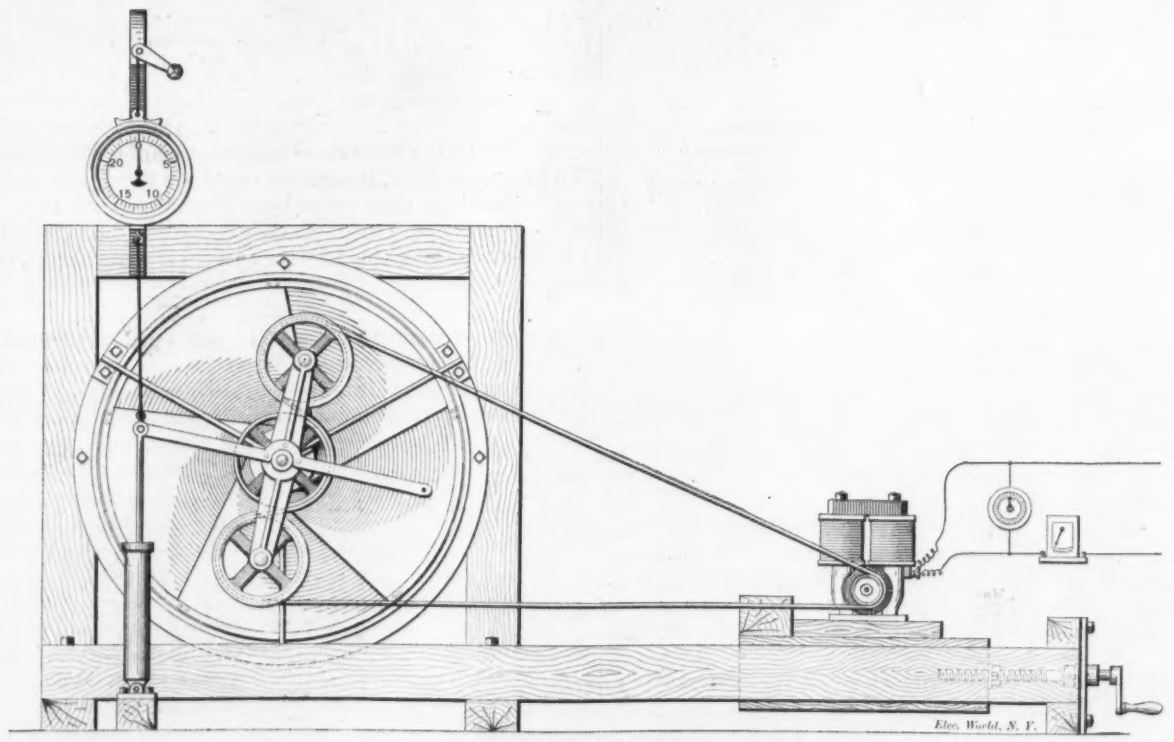
The characters on the type wheels are forced against the sheets of paper by means of a series of levers, one for each wheel. The printing levers are acted upon by a series of printing magnets arranged in the same circuit, controlled by a transmitter, and are governed in their action by a series of discs, one for each printing lever, which are secured to a shaft parallel with the type wheel shaft and controlled by an escapement under the influence of a transmitter. The series of discs upon the shaft are notched, with one notch in each disc, and so arranged that the notches make a spiral around the shaft. The printing levers bear at their rear ends upon these discs, and so are held from printing *except* when they register with the notches in the discs. But one printing lever can register with the notch in its disc at a time, so that only one impression can be taken at a time, although *all* the printing magnets are energized at the same time. The paper-feed is controlled by an escapement which is governed by a polarized magnet, and may be operated at any time by sending a weak reversed current over the line controlled by one of the transmitters. Unison devices are also provided for the type wheel and disc shafts, so as to unison the type wheel and the printing lever discs.

The paper, which is drawn step by step over the platen bar, is arranged upon a roller held between two shafts. The free end of the paper is held by the notice board, upon which the names of the stocks to be printed are so placed that they can be changed at pleasure, so that when a stock or commodity becomes inactive, an active stock or commodity may be substituted.

The sign or notice board is as wide as the paper roll. There are the same number of names upon it as there are type wheels upon the shaft, and the type wheels are in a direct line with each column of quotations, so that in looking for any stock all that is necessary is to look at this board for the name required, and the fluctuations in the prices will be found under this heading. Every two columns of quotations are printed in alternating colors of red and black, as the eye sees and holds the position better when alternating colors are used. This is done by supplying the inking-wheels with different colored inks.

In printing stock quotations on this machine where the quotations of each stock are collated and displayed under its own heading, and there is a rise or fall of a fraction only, it is not necessary to give the whole number, but only the fraction, as it will be understood that the fraction will refer to the last preceding whole number which has been printed previously. Instead, therefore, of printing the symbol and two or three characters and a fraction, which would be necessary when the stocks are commingled, as in the ordinary stock-printer, by this system the fraction only need be printed, thus dispensing with the printing of three or more characters, which permits of an increased speed of operation.

Some of the stocks in the market are known as "inactive stocks," and, being dull, there is not much need to give the quotations of these stocks, except occasionally. To print these on this machine two columns are set apart upon the bulletin, which are placed in the centre of the bulletin, and designated by the characters. In one column is printed the symbol of the stock, and in the other column adjacent the quotation thereof. The character wheel is provided at one side with the symbols of the stock, and at the other side with the diagonal arrangement of figures, as in the other type wheels.



THE WHEELER DYNAMOMETER.

A New Dynamometer.

BY S. S. WHEELER.

The measurement of power is much more difficult than is generally supposed, because there are special obstacles which do not apply to ordinary measurements of other quantities, and these difficulties are not usually realized until encountered in experiment. In addition to the act of reading the indications of the measuring instruments, which is usually the chief responsibility, and in which occurs the main chance of error in ordinary measuring, there are several classes of allowances to be made in measurements of power, and as the amounts of these cannot be determined accurately, there is always some degree of uncertainty about the correct result.

Through the various stages of conversion, energy is constantly suffering losses by dissipation. In fact we can only become cognizant of it when some of it is expended in producing an effect. Therefore, when measurements are being made, the operation is accompanied by losses of power great and small, at every step. The most obvious of these losses is that represented by the amount of power consumed in operating the measuring apparatus itself, and the best that can be done is to construct the apparatus to run so easily that the power lost in running it shall be reduced to a minimum, and then to determine this loss as accurately as possible and make allowance for it. At the same time it is necessary to increase this allowance when measuring a heavy load, as the increased strain on the apparatus increases the friction.

Another element of uncertainty which is still more indefinite is the loss by friction in the motor; but this should not be included, because it is properly a part of the action of the motor. The friction of rotation of the motor is evidently a part of the cost of production of the power, and the measurements should always be of the net power realized after this is deducted. On the other hand, measurements are frequently made with the motor belted to the measuring apparatus. In such cases the friction of the belt also reduces the power recorded, while it is evident that the belt is not a part of the motor, and that the motor is giving more power than is shown by the instruments. Again, in determining the velocity, if the number of feet the belt travels in a minute is measured, the correct value is not obtained, because the motor will do some work in slipping its pulley under the belt; while, if the revolutions of the motor are taken as the basis, it is uncertain how the belt will bend, that is, what the virtual diameter of the pulley is, or how far it will move the belt per revolution. It may move it a distance equal to the circumference of the pulley; or again, if it were on a pulley whose radius extended out to the centre of the belt; but it probably moves it a distance between these two. Many other questions of such allowances are to be considered, of which those just mentioned are a mere hint and the causes for allowances and the construction of apparatus to make the measurements as accurately as possible is of great importance; but the rapid increase of complication and of the care required in using the necessary instruments employed for securing the last degree of accuracy, makes it a serious undertaking, involving considerable labor, to make an extremely accurate efficiency test.

The necessity of having instruments for ordinary shop work for measuring easily and quickly the approximate power of machines, gives occasion for an entirely different class of apparatus, namely, that in which convenience of operation and simplicity are considered first, and only a fair degree of accuracy is attained. And the result is two widely different classes of dynamometers, namely, those designed for great accuracy, and those for great convenience.

The fine, accurate dynamometers are suited to laboratory work, but in every day work they are shunned, and when they are the only available instrument the measurements are neglected, on account of the time it would take to make them. Whereas, if a convenient instrument were at hand, it would be used and fair accuracy attained.

The dynamometer shown in the accompanying illustration, is designed for this purpose, viz.: great convenience and reasonable accuracy. It embodies the essential feature of the large Tatham power-weighing machine as manufactured by Fairbanks, but is divested of all the extra parts.

In the engraving is shown a fan which is used to absorb

the power of the motor. The belt from the motor is held against the driving wheel of the fan (the middle wheel) by two loose pulleys mounted on spindles which are fastened to the extremities of a balancing beam. This beam is mounted loosely on the shaft of the fan, so that it is free to swing round and to carry the two loose pulleys at its ends concentrically around the central pulley, which is fast to the shaft.

As the power transmitted is proportional to the difference in tension between the tight and the slack side of the belt, it may be measured by determining with a suitable weighing scale the pressure exerted upon the balancing beam to drag it around in the direction the belt moves.

For convenience in using the weighing scale to measure the tension on the beam, the scale is arranged to hang vertically, being attached to a right-angle branch of the beam, but at the same distance from the centre of the shaft that it would be if attached directly to the belt where the latter passes over the outside of either of the outer pulleys. With this arrangement it is easily seen that the scale measures the exact tension *transmitted* through the belt, and this, multiplied by the number of feet that the belt moves per minute, gives the foot-pounds per minute measured, which can easily be converted into horse-power.

The scale is supported by a cord wound up by a crank, so that as the scale spring stretches, the angle of the arm may be readjusted to be at right angles to the belt when taking a reading. This also furnishes a means of eliminating the friction of the beam on the shaft by moving it slightly in one direction, and then slightly in the opposite direction and taking the mean of both readings.

The frame of the fan is extended to form a convenient support for the motor, and an adjustable clamping base is provided. The general form of the instrument is the same as a very small model exhibited before the American Institute of Electrical Engineers, February, 1887. The beam and pulleys, which constitute the essential part of the apparatus, may be slipped on to the end of the shaft of any machine of which it is desired to measure the power.

The Van Depoele Electric Railway at St. Catherine's, Ont.

We give on this page an illustration of the electric railway at St. Catherines, Ont., now working so successfully on the Van Depoele system. The line is 116 yards short of six miles in length. It is one succession of grades and curves, and one of the heaviest grades is on a curve. There are a number of grades of 6 feet in the hundred, one of 400 feet in length 7 feet in the hundred. In fact, in the whole six miles there is only one straight run of 1,500 feet on the level. The company has at present 5 motor cars, 15 h. p. each.

It is equipping a car every two weeks and intends by the 1st of May to have 12 motor cars running. The road was very hard on horses on account of the grades, and as the company gets its water-power from the Welland Canal at a nominal figure—90 cents per h. p. per annum for 400 h. p.—the saving by the change to electric motors is greater than it would be to use steam to generate the current. The secretary of the road has calculated that the company saves by the change, after deducting the interest on the electric plant, about $18 a day.

But this is not all. As the company is able to give the public cleaner cars and more rapid transit, the passenger business has increased about 35 per cent. The motors are placed on the front platforms of the horse-cars and the drivers had no difficulty in learning how to handle the machines. The company has not had a single mishap of any consequence to its electrical machinery, and though the municipal authorities were very slow to give it permission to adopt electricity, they approve of the change. The drivers and conductors seem to have more respect for themselves than they did in the horse-cars—look better, take a pride in keeping their cars nice and clean, and are more polite to the passengers. In fact, aside from the increase in business and saving to the company in operating expenses, Mr. E. A. Smyth, of the company, says he would not have the care and trouble of a stable full of horses on any account.

One terminus of the road is 285 feet higher than the other, and the track has been pronounced by all the electricians and street railway men that have been to see it as the most crooked and hardest line to operate they had ever looked at. It is found that five electric cars do as much work as eight horse cars.

THE VAN DEPOELE ELECTRIC ROAD AT ST. CATHARINE'S, ONT.

Designing "Iron-Clad" Dynamos.

BY J. WENSTROM, SWEDEN.

As my specialty since the beginning of the year 1882 has been to design "*iron-clad*" and similar dynamos, the priority of which has occupied several correspondents in some of the last issues of this valuable paper, I take the liberty to furnish some dates about my dynamo system.

As said before, the system was brought out early in the year 1882, and the first patents were applied for in the fall of the same year, the application in the United States being filed Dec. 7, 1882. The United States patent was issued Jan. 15, 1884, No. 292,079, and was noted, with an illustration of one type of my dynamos, in THE ELECTRICAL WORLD, Feb. 2, 1884.

This patent covers several types of iron-clad magnets—with two poles, four poles, or more pairs of poles, and with the magnet coils on each side of the armature or surrounding it. For this reason I think that I may claim priority in several particulars as compared with the designers named by the said correspondents.

My dynamo system was also illustrated and described in this journal, 1886, Vol. VII., p. 213. It contains also other valuable features, of which one especially is that the armature wire is inlaid in cylindrical recesses in the iron core itself, a feature which, as all are aware, just makes the renowned but more recently designed Oerlikon dynamo so prominent and efficient.

Hitherto the application of my system has been almost entirely limited to Sweden, where the proprietors of the Swedish patent (the Electrical Company, Limited, in Stockholm) since 1883 have installed a great many such machines. But now I hope that it will come into use abroad within a short time, and I am sure that its transplanting to America's fertile soil will make its good features more noteworthy than ever.

At the present time a dynamo of my system is running in New York.

An Electric Sleep Preserver.

BY WM. MAVER, JR.

In a recent issue, the English *Medical Journal* propounding the query, What is it that disturbs sleep? remarks that the popular view that noise is the disturbing cause, touches the truth without grasping it. It cannot be noise altogether, for the inhabitants of besieged towns have been known to sleep through the roar of bombardment, and to waken suddenly when the firing ceased, and we all know that the sleeping miller awakes when his mill stops running. The rattle of a train in motion will induce sleep, as even those who are ordinarily very poor sleepers often find. The true cause is, interruption; a sudden cessation of either continued silence, or of sound, awakens. For sound, providing it be monotonous, has precisely the same effect on the brain as silence. The alarm-clock is based on this theory of interruption. It interrupts silence. This leads the *Journal* to make the suggestion that a simple contrivance might be made on the same mechanical principles, but with the object, viz.: that of insuring sleep by sound.

Its utility to delicate persons especially would be undoubted. Call it the "morphiometer" or "somniferant," or christen it "the sleep preserver"—a name that would truly designate its object—for its real purpose would be not so much to promote sleep as to insure the sleeper against disturbance (the vulnerable side of light sleepers) by placing a bulwark of sound between him and the sudden shock of extraneous noise. Let your sleep preserver produce the drowsy monotonous buzz of the humming top—not so loud as to be heard in an adjoining room, but when placed close to the bedside or hung over the pillow loud enough to drown distinct noises.

This suggestion is certainly well worth the trying, and it is within the province of an electrical journal to add the information that electricity and magnetism stand ready to supply, by the aid of simple and efficient apparatus, a means of demonstrating the utility or otherwise of the suggestion.

All that is necessary would be for the physician to choose a tuning fork or reed giving a tone which he may think most desirable, and have it attached to a magnet in the well known way, to produce that tone. This, with the necessary battery, could be placed in an adjoining room or in any out-of-the-way place, and its noise deadened by suspending it on rubber bands. From this instrument the circuit of the secondary coil could be led by covered wires to the bedside and a telephone receiver put in the same circuit and suspended over or placed upon or under the pillow, where it would give out the "drowsy, monotonous buzz of the humming top," or any other sound desired. Indeed, a blended tone of several notes could be easily arranged. The volume of sound could be altered at will by the use of a small resistance box, or, so far as the invalid is concerned, by approaching or withdrawing the telephone receiver itself.

As to the likelihood of the buzz ceasing abruptly by such causes as sticking at the contact points, etc., and thus "interrupting the noise," there need be put little fear if care is exercised in procuring suitable reeds and contacts. Reeds, so-called, and by which are meant single-tined vibrators, are more reliable than the ordinary tuning fork vibrator. Electrically actuated reed vibrators or "buzzers" have been known to run for days at a time without interruption. All of the materials for this experiment could be procured at any electrical supply store at trifling cost, and as for the telephone receiver, any common form would suffice, and could be employed, as no general patent covers such use.

A Challenge for Secondary Battery Cars.

To the Editor of The Electrical World:

SIR: In your issue of Dec. 24 I notice a communication from Mr. C. O. Mailloux, in which he endeavors to explain why 40 miles is equal to 45 miles, and he appears to have answered the question, "What has become of the shortage of 5 miles," to his own satisfaction, by showing that it was lost in the mud. This seems to be a somewhat muddled explanation. He has also apparently not seen the notice in your issue of Dec. 17, giving a later run (Dec. 8) of our Reckenzaun car, to wit, 63 miles 211 feet, with one charging of the batteries. In this run there were 331 curves of 33 feet radius, 662 curves of 50 feet radius, and 331 curves of 100 feet radius (the curves averaging a right angle of 90 degrees each), besides 5 miles 2,390 feet of 5.8 per cent. ascending grades. Perhaps Mr. Mailloux may consider that his 40 miles is also equal to this 63 miles. If he will bring his car to Philadelphia I will pay all expenses of transportation, etc., and his car fare, and will give him every facility for running upon the same track. We will then take three runs, with one charging of the batteries to each run, with his car, and the same number of runs with our Reckenzaun car. For every mile that his car makes more than our Reckenzaun car makes I will pay $100, *provided* that he pays $50 for each mile that his car makes less than our Reckenzaun car, the money to be handed over to such charitable organization as the editor of THE ELECTRICAL WORLD shall designate. We will give him every facility to have a fair chance and show what he can do.

WM. WHARTON, JR.,
President of Electric Car Co. of America.

Berliner's Molecularium.

Numerous devices have from time to time been constructed for the purpose of representing graphically the supposed molecular actions which give rise to the various manifestations of energy, such as heat, light, electricity, etc., but while some exemplify a theory very well in certain respects, they lack comprehensiveness and fail to explain all the phenomena observed.

In considering the means for bringing the molecular actions accompanying electrical phenomena in bodies vividly before the mind, Mr. Emile Berliner, the well-known inventor, of Washington, D. C., has constructed an apparatus which he has called a "molecularium," and by means of which the larger number of electrical phenomena can be explained on the theory of molecular vibration.

The apparatus consists of six soft rubber balls, Fig. 2, which are mounted in frictional contact with each other, so that when one is rotated around an axis all the others will rotate. Each of these rubber balls represents a molecule, supposed to be itself elastic, or a non-elastic body with an elastic envelope (ether?). The molecule is supposed to be endowed with a *permanent molecular force*, which holds it in a certain position toward all the other molecules, so that when this position is disturbed the molecule will be under stress and will endeavor to resume its original position when the cause of disturbance ceases to exist. This permanent molecular force is represented in the molecularium by one or two spiral springs fastened around the supposed axis of rotation of the molecule and fixed to a frame in such a manner that it will resist a rotation of the molecule in either direction, Fig. 1.

Furthermore, it is assumed that each molecule has an inherent electrical polarization, which in the molecularium is expressed by coloring one-half of each of the balls a dark red and leaving the other half in their natural gray, as represented in Fig. 1.

It may, of course, be assumed that instead of such a mounting we may represent the molecules as a series of rubber balls with bar magnets passing through their centres and floating on water. The magnet would represent their inherent electric polarization, and the balls would assume a certain position of equilibrium which they would again assume after any disturbing influence had passed.

As, however, we are dealing for the present with solid conductors which have a certain regularity of structure, Mr. Berliner assumes, in the molecularium, the existence of a limited axis, although it appears certain that this limit has a greater range than that of a single axis (*twist, axial plane, etc.*).

For the sake of convenience a handle is attached to one of the end molecules and a check is provided for the handle to rest against, when in the normal position, representing depolarization. This normal position is shown in Fig. 2.

As seen here, the molecules with their inherent polarities are so arranged that these polarities oppose and neutralize each other, it being assumed that the molecular force is greater than the force of inherent polarization; or, that inherent polarization adapts itself, and is subservient, to molecular force. Thus, in a molecule of water the atoms consist of negative hydrogen and positive oxygen in opposition to each other and divided by the axial plane of rotation. But the question would still remain, how a liquid element, such as liquified oxygen, would act under attempted polarization. In solid elements their structural condition would indicate a limited series of axial rotations.

We now pass to the various demonstrations by means of the molecularium of the phenomena of electrical polarization along a continuous conductor.

Static Charge and Discharge.

The end ball being given a quarter rotation by the crank, all the other balls will rotate within that limit around their axis and assume the positions shown in Fig. 3. The molecules are now represented as being under electrical stress or polarization, and when the crank is suddenly let go they fly back to their original position, or beyond, as will be shown later. This operation represents a *rapid discharge.*

Again the crank may be permitted to move back slowly against the partially resisting pressure of the hand which holds the crank, which operation would represent a *slow discharge.*

But polarization is supposed to be indicated by the slightest rotary motion of the crank, and the various angles of rotation represent the *various electromotive forces* possible, while the springs represent the molecular resistance to rotation; *i. e., specific electrical resistance.* To this may be added loss of power in long conductors, *i. e.*, enfeeblement of rotation as the distance increases, which represents *difference or fall of potential.*

In a continuous current this enfeeblement will only gradually be overcome before the full influence of continuous initial rotation will make itself felt. This is equivalent to the *gradual charge* of a long conductor.

When, however, a sudden discharge takes place, the return rotation will be accelerated by the separate rebound of each molecule back to its original position, and the momentum thus given may rotate the molecules beyond their original positions before they come to a standstill. This would represent a case in which the discharge is quicker than the charge, and the action would rotate the molecules back in a greater degree or with greater electromotive force, but in opposite direction. This would represent the *extra current in a voltaic circuit.*

Voltaic Current.

A single zinc molecule, when torn off by chemical decomposition in a battery, is supposed to rotate the nearest molecule in the circuit and thereby polarize the same as in a static charge.

In a Daniell cell the degree of rotation which the zinc molecule imparts to a conductor is smaller than that produced by a Grove cell, *i. e.*, there is a *difference of electromotive force*, between the two. As one zinc molecule, however, is followed by millions of others in rapid succession, no static discharge can take, place and a struggle, as it were, ensues between the molecular forces of the con-

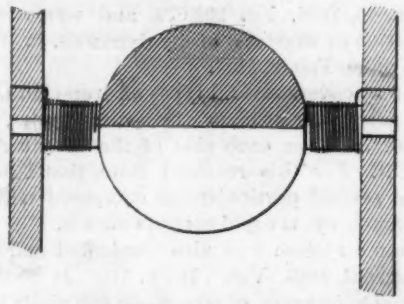


FIG. 1.—BERLINER'S MOLECULARIUM.

ductor acting against the rotating influence of the zinc molecules; and while the *principal phase of rotation is maintained* a rotary *vibration* occurs at this phase, caused by rotation and counter rotation. This is represented in Fig. 4.

Here, *a b c* is the principal phase, or E. M. F., and *d e* is the amplitude of vibration of the line *a b.*

This would apparently represent a rapidly alternating current, but the vibration is so small in proportion to the

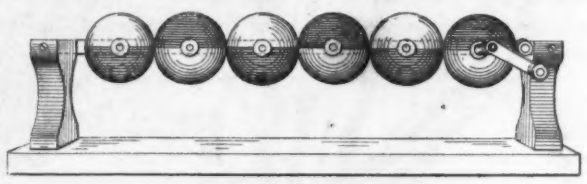


FIG. 2.

principal phase of rotation, and so rapid that its existence cannot manifest itself, except in

Heat

due to molecular vibration (friction?). This heat may be increased either by more rapid vibration, *i. e.*, more zinc molecules, or in other words, increased *quantity* of *current;* or by a greater E. M. F.; and in both cases the resistance of the conductor when increased increases the

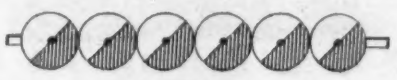


FIG. 3.

friction and thereby produces more heat, and subsequently *light.*

As the E. M. F. increases, the rotation of the molecule is not increased in proportion, because the power of counter rotation by the molecule (tension of spring) increases in an inverse ratio—*tangential function*—and may therefore become almost infinitesimal when nearing the full quarter rotation; and the heat (vibration) may become

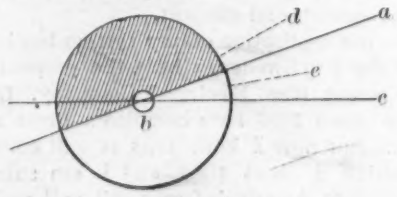


FIG. 4.

so intense as to release the molecules from their molecular attractions or molecular bearings and dissipate them—*i. e., vaporization* would take place.

This does not mean that heat can be produced only by rotary vibration, for it may be produced by rapid shocks or molecular bombardment.

As an illustration, let us assume that a hundred billiard balls are massed together on a large billiard table. A separate ball is shot by a cue against the mass, which will only be slightly loosened thereby. But, as continuous balls are rapidly shot against it, the balls eventually fly apart and against each other, and finally scatter in all directions.

The Work of the American Institute of Electrical Engineers.

Mr. R. W. Pope, the Secretary of the American Institute of Electrical Engineers, calls attention to the fact that the Institute has begun in its monthly issue of "Transactions," an index of current electrical literature, dating from October. The permanent value of such an index to electricians and the scientific public is apparent, and may be ascertained from an inspection of the number sent with Mr. Pope's letter, as it contains references to more than 300 distinct articles, cited from 18 papers and periodicals, which are regularly indexed each issue, and from about 50 journals in all. Subsequent issues will comprise the leading electrical publications in foreign languages. A standing list of these periodicals, with the publication address, price, etc., will also be printed when space permits. This is evidently a task of the first importance in value and utility. With the rapid development of electricity it is difficult to keep pace with all the work being done, and it is utterly impossible to recall, unaided and when reference is necessary, all the things that impress one from time to time. This Index meets the necessities of the case very fully, and will, of course, be more serviceable as it grows and as time shows in what respects it can be added to and improved. The Transactions of the Institute were valuable before, but their usefulness to the members has certainly been increased tenfold by this new departure. Mr. Pope is to be congratulated on the excellence of the publications issued by the Institute.

That appreciation of the good work being done by the Institute is not wanting abroad is shown in many ways, and may be exemplified by the following from *Engineering* of December 9: "This corporate body, which was established in New York on May 13, 1884, is a national organization of scientific electricians and electrical engineers, and the high character it aimed at has been steadily maintained. Its records show that it may be considered abreast of the electrical societies of the whole world for scientific ability and enterprise. The Transactions of the Institute include papers on all branches of electrical engineering, and the list of members includes the leading electricians of America. It is, in short, the American counterpart of our own Society of Telegraph Engineers and Electricians, with, however a more comprehensive title, and one which might be advantageously adopted by our own Society at this stage of its existence. The American Society intends to establish a library, a museum, and perhaps an experimental laboratory. To this end the Society is making an effort just now to purchase a building in New York for the complete accommodation of the members and their guests." It may be noted that the great English society above referred to has already signified its intention of making a change in its title as above suggested, and proposes to be known as the Institution of Electrical Engineers.

Carbon Electrodes for Secondary Cells.

BY A. V. MESEROLE.

Carbon has been considered an ideal substance for secondary battery electrodes on account of its constant conductivity and indestructible nature. Common battery carbon is not at all suitable for this purpose, probably on account of the foreign matter usually combined with it. Electrodes composed of mineral or gas carbon will not absorb or retain enough electrical energy to be of any practical use in a secondary battery. There is always some local action, and when a charging current is passed through the cell large quantities of sulphuretted hydrogen gas are set free.

A very fair secondary cell, however, may be made with carbon as an active absorbent, by using certain vegetable carbonized substances, such as bamboo, boxwood, and the like, which form good conductive carbon. This may be pulverized and mixed with variable proportions of graphite and pressed into porous pots or bags. The material should be worked into a paste with acidulated water, and then compressed within the porous-retaining envelope along with a number of conducting plates or rods composed of an alloy of lead and antimony, amalgamated with mercury. The usual grid also may be filled in with this plastic material, and then closely wrapped with asbestos tape or cloth to prevent washing out.

The addition of oxide of lead to the mass forming one electrode will increase the capacity of the element, and so would the addition of oxides of various other electro-negative and electro-positive metals to the respective secondary poles. The addition of any quantity of metal or oxide would, of course, introduce objections which the use of carbon alone is intended to avoid. The use of a pure carbon grid containing a pure carbon active absorbent would be preferable in many respects. It would have a constant conductivity, would be practically indestructible, and would permit the use of any desired electrolyte, which may be the key to future improvements in secondary batteries.

The Power of Motors.

To the Editor of The Electrical World:

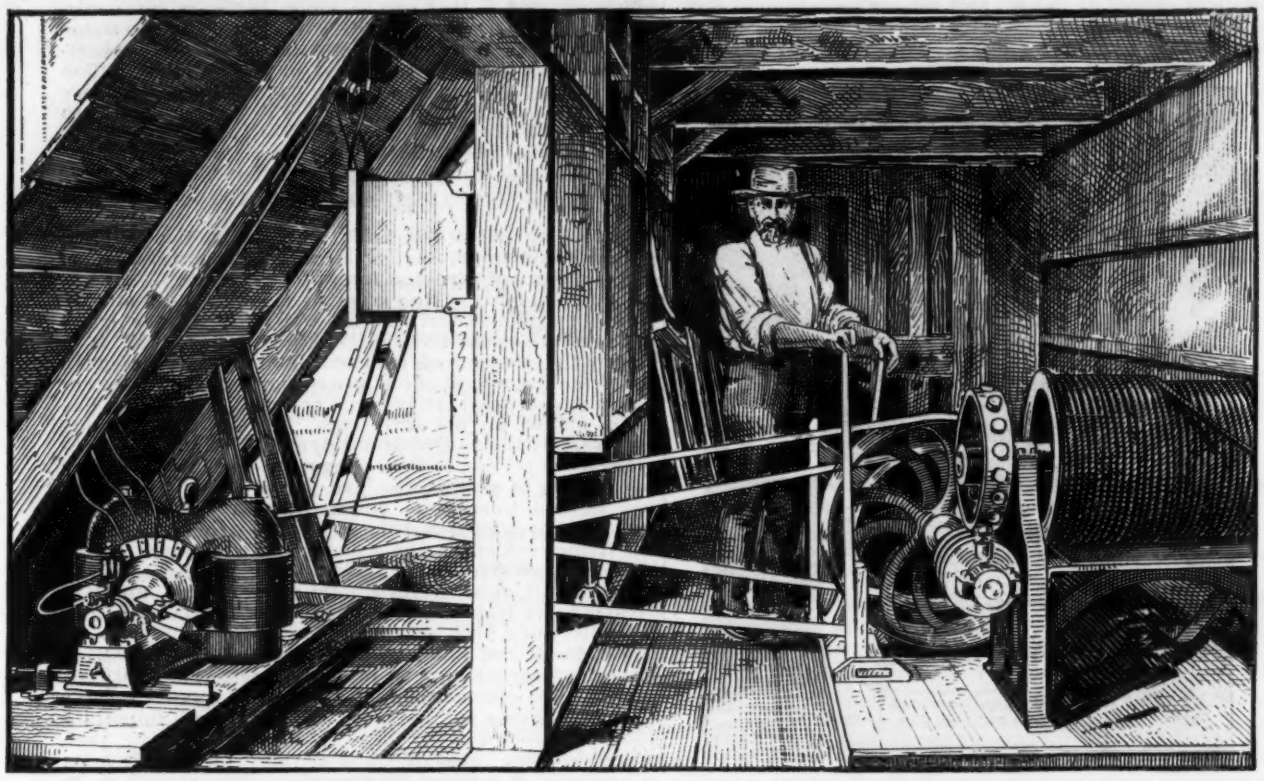
SIR: Please let me know through your columns if a 2 h. p. engine can run a generator of 100 volts, and can a generator of 100 volts run an electric motor rated at 3 h. p.? J. C. S.

WORCESTER, Mass.

ANSWER.—An engine of 2 h. p. can drive a generator to deliver a certain strength of current (about 12 ampères) at 100 volts. But this current would not drive a 3 h. p. motor at its full capacity. It would only be able to drive the latter to about 1.3 h. p. This is based on the assumption that generator and motor have an efficiency of 80 per cent. each.—EDS. E. W.

The Electric Motor in Building Operations.

The wonderful adaptability and economy of the electric motor is nowhere better demonstrated than in the work performed by it in the erection of the new capitol buildings at Topeka, Kan. Several Sprague motors are here employed for the purpose of hoisting the heavy blocks of granite, brick, mortar, etc. One of the motor plants, situated in the second story of the building, is shown in the accompanying illustration. Its simplicity is such that no further description seems necessary. Another motor is attached to a traveling derrick and easily handles granite blocks weighing eight tons.



SPRAGUE MOTOR IN BUILDING OPERATIONS, TOPEKA, KAN.

The current is furnished from the Edison circuits, and as the power is only used at comparatively long intervals, the cost of operating the motors is but small, as compared with steam.

Edison's New Phonograph.

As was announced some time ago Mr. T. A. Edison has devoted considerable of his time recently to the perfection of the phonograph brought out by him ten years ago. In that instrument, it will be remembered, the inventor recorded speech by the indentation of tinfoil caused by a stylus attached to a diaphragm against which the words were spoken. In the new instrument, however, the tinfoil is replaced by a cylinder of wax, in which the record is engraved or cut out by the recording stylus. This, together with a number of interesting details for obtaining better articulation, constitutes the main improvement in the new instrument, which is illustrated in the accompanying engraving, for which we are indebted to the *Scientific American*.

In its construction the new machine resembles in several respects a very small engine lathe. The main spindle is threaded between its bearings, and is prolonged at one end to receive the hardened wax cylinder upon which the sound record is made. Behind the spindle and the cylinder is a rod upon which is arranged a slide, having at one end an arm adapted to engage the screw of the spindle, and at the opposite end an arm carrying a pivoted head, provided with two diaphragms, whose positions may be instantly interchanged when desirable. One of these diaphragms is turned into the position of use when it is desired to talk to the phonograph, and when the speech is to be reproduced, the other diaphragm takes its place.

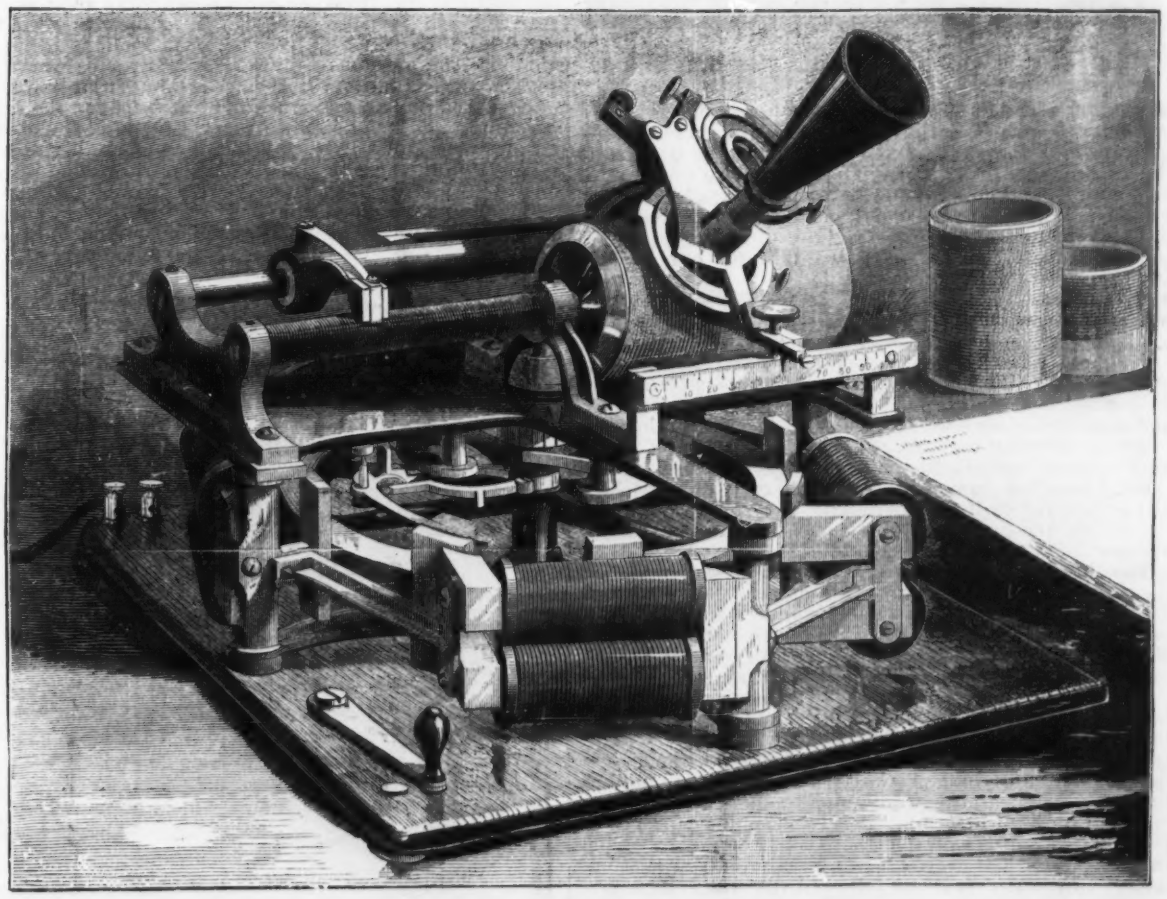
The needle by which the impressions are made in the wax is attached to the centre of the first diaphragm, and pivotally connected to a spring arm attached to the side of the diaphragm cell. The device by which the speech is reproduced contains a delicate diaphragm of gold beater's skin, to the centre of which is secured a stud connected with a small curved steel wire, one end of which is attached to the diaphragm cell. The spindle of the phonograph is rotated regularly by an electric motor in the base of the machine, which is driven by a current from one or two cells of battery. The motor is provided with a sensitive governor, which causes it to maintain a very uniform speed. Motion is transmitted from the motor to the spindle by beveled friction wheels. The arm which carries the diaphragms is provided with a turning tool for smoothing the wax cylinder preparatory to receiving the sound record.

The first operation in the use of the machine is to bring the turning tool into action and cause it to traverse the cylinder. The turning tool is then thrown out, the carriage bearing the diaphragms is returned to the position of starting, the receiving diaphragm is placed in the position of use, and as the wax cylinder revolves the diaphragm is vibrated by the sound waves, thus moving the needle so as to cause it to cut into the wax cylinder and produce indentations which correspond to the movements of the diaphragm. After the record is made the carriage is again returned to the point of starting, the receiving diaphragm is replaced by the speaking diaphragm, and the carriage is again moved forward by the screw as the cylinder revolves, causing the point of the speaking diaphragm to traverse the path made by the recording needle. As the point of the curved wire attached to the diaphragm follows the indentations of the wax cylinder, the speaking diaphragm is made to vibrate in a manner similar to that of the receiving diaphragm, thereby faithfully reproducing the sounds uttered into the receiving mouthpiece.

The perfect performance of the new instrument depends upon its mechanical perfection—upon the regularity of its speed, the susceptibility of the wax cylinder to the impressions of the needle, and to the delicacy of the speaking diaphragm. No attempt is made in this instrument to secure loud speaking—distinct articulation and perfect intonation have been the principal ends sought.

The little wax cylinders upon which the record is made are provided with a rigid backing and the cylinders are made in different lengths; the shortest—one inch long—having a capacity of 200 words, the next in size 400 words, and so on. These cylinders are very light, and a mailing case has been devised which will admit of mailing the cylinders as readily as letters are now mailed. The recipient of the cylinder will place it on his own phonograph and listen to the phonogram—in which he will not only get the sense of the words of the sender, but will recognize his expression, which will of course have much to do with the interpretation of the true meaning of the sender of the phonogram.

As already announced by us, extensive preparations for the manufacture of the phonograph have been made, but the instrument designed for commercial use will probably have a somewhat altered appearance from that shown in the engraving.



THE NEW EDISON PHONOGRAPH.

Station Lighting on the Boston & Albany Railroad.*

BY G. W. BLODGETT.

At East Boston the following points are lighted by electricity: First, the grain elevator, which has six lamps in a single line opposite the scales where the grain is weighed; second, freighthouses Nos. 6, 12 and 13 on the east; and freighthouse No. 5, pier No. 1 and the entrance on the west, where ocean steamers load and discharge their merchandise or freight to the cars; third, a coal wharf near the elevator, where the coal from the vessels is discharged into the cars on the tracks 10 feet below; fourth, two engine buildings, one for the elevator engine and the other for the electric light engine. There are also several lamps in the yard near the most important switches and crossings. All these lamps are Brush lamps of 2,000 nominal candle-power. In the buildings they are placed 14 feet high, which was the greatest height which the construction of the buildings permitted. Out of doors the height is 24 feet. Although there are 48 lamps, only 36 can be operated at the same time, which is the full capacity of the dynamos. Each lamp can be extinguished by a switch when it is not needed. It is sometimes necessary to use a larger number of lights than can be operated by the dynamos. A choice is then made of those most indispensable, and the lighting is completed by gas or oil lamps furnished with reflectors.

Electric light is used only when the number of lamps needed is nearly the capacity of one dynamo; that is to say, 18. When only two or three are needed, the gas is used.

The cost of the electric apparatus at East Boston, in place, was as follows: Buildings, $3,116.12; 60 horse-power engine, in place, $1,737.10; shafting, pulleys, etc., in place, $364.29; belting, $412.30; two Brush No. 7 dynamos, $4,000; 44 lamps, with two sets of carbons, $3,520; two regulators for the dynamos, $250; wires, insulators, telegraph poles and cross-arms and labor in setting up the machinery, lamps and wires, $1,322.75; total, $14,722.56. The boilers used for the elevator engine also supply steam for this, and the cost of boilers or boiler-house is therefore omitted from these items. The cost of operation during the year ending Sept. 30, 1886, was $2,277.34, or $7.28 per day, or 20 cents per lamp per day, assuming 36 are used. This includes fuel, but not cost of boilers or boiler house. The lamps are used irregularly. When a vessel is at the wharf they are usually burned the whole night until the loading has been completed, when they are, perhaps, not used again until another vessel arrives, if it be delayed, unless the elevator is to run at night, or cars are to be unloaded. Two men are employed to run the engine and dynamos during the night and replace the carbons in the lamps during the day. They work as many hours as is necessary—sometimes 20 hours or more in the day, when the lamps burn all night, and sometimes only four or five hours. The average is about 10 hours for the whole year. When the electric lamps are not used, these men are employed in repairs, and other work for which there is not time when the lamps are used many hours.

At Boston the passenger station, the train-house and yard are lighted by 33 arc lamps and 12 incandescent

*Abstract of paper presented before the International Railroad Congress at Milan.—*Railroad Gazette*, Dec. 30.

lamps. There are two Brush dynamos of 16 lamps each, and as they are run at a speed of 825 in place of 750 turns per minute, 18 lamps can be used instead of 16. They are placed at a height of 12 feet, except 5, which are about 24 feet high. Four men are employed; two renew the carbons and make repairs to the apparatus during the day. Two others work at night; one for the boilers and engine, and another who operates the dynamos and patrols the circuits to see that all lamps burn properly. The lamps have double carbons and can burn all night. They are lighted as soon as it begins to be dark in the station, and run until after the arrival or departure of the last train. The station is lighted in the morning an hour before the departure of the first train. In summer the morning lighting is not necessary.

The cost of the apparatus, not including the engine or boilers (which are in use by the repair shops), was as follows: Two Brush dynamos, $4,000: 33 double arc lamps, $2,640; 2 single arc lamps, $120; 2 automatic regulators for the dynamos, $250; wires, insulators, fixtures, etc., and work of setting up the apparatus, not including the main shafting, etc., $1,206.47; total, $8,216.47. The cost of operation for the year ending Sept. 30, 1886, was $6,465.11, or $184.72 per lamp per year, or 50.6 cents per lamp per day. The cost per lamp hour under these conditions was about 6 cents. The cost of power furnished by the motive-power department is $2.50 per day, besides the wages of the engineer. Carbons cost about 80 cents per day; oil waste, etc., about 3 cents per day. The cost of repairs to 5 Brush machines during the 6¼ years of use has not been, it is estimated, more than $150. Neither a lamp nor dynamo has yet been replaced or sent to the factory for repairs. All such have been made by the men in charge of the apparatus. These installations were the first by a railroad company in New England, if not in America, and are still the most extensive. At Worcester, the passenger station is well lighted by 20 arc lamps, placed about 15 feet high in waiting rooms and 24 feet in the train-house. The cost is about twice as much as formerly paid for gas (which was never satisfactory), but several times the amount of light is obtained. The cost is 70 cents per lamp per night. It costs about the same at Springfield. At Pittsfield the electric light company light the passenger station for the same price formerly paid for gas, about $1,400 per year.

Electricity in its Relation to the Mechanical Engineer.*

BY PREST. G. H. BABCOCK.

Yet another great force, or manifestation of force, in nature is already yielding its neck to the yoke prepared for it by the mechanical engineer. Electricity had long

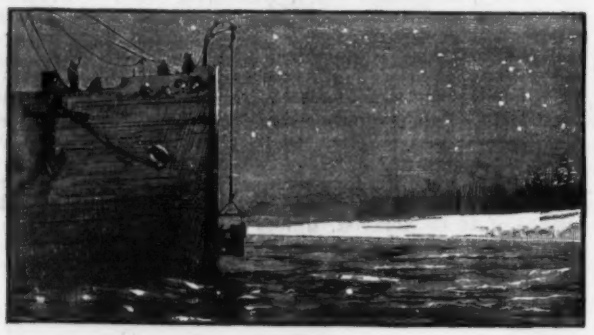


FIG. 1.—NAVIGATION OF THE SUEZ CANAL BY NIGHT.

been known as a terror, and had been played with as a toy, but our own Franklin, in this very city where we are now assembled, was the first to show that the terror and the toy were one. Other ready hands took up the work of subduing it, and now it rings our call bells, lights our gas, watches sleeplessly in our dwellings for burglars, regulates the heat in our rooms to a fraction of a degree, makes our plated ware and electrotypes, duplicates our medals, and starts our exhibitions at the nod of a president or a king a thousand miles away. It floods our streets and public halls with light, and furnishes a tiny fire-fly lamp to explore the inner recesses of our bodies. It drives our sewing machines and our street cars, and is even trying its hand at boats and railways. It concentrates into a point the heat equivalent to 500 horse-power of work, and vaporizes metals we have scarcely been able otherwise to melt. It welds together rods and shafts, as it were, with a touch, and smelts the most refractory ores.

But I need not enumerate the wonders which mechanical genius and skill have wrought in this our day, in the line of the first grand commission to "subdue the earth." You see them all about you.

The question only remains: What will be the outcome? To what shall we look forward as the field for future achievement? Can we go on at the same rate of advancement, or must we stop for want of other worlds to conquer? Towards the end of the last century—after Priestly had discovered oxygen, Galvani had found the supposed secret of life, the Leyden jar had shocked crowned heads as well as philosophers, Watts had brought steam into practical use, Arkwright had invented the spinning frame and Cartwright the power loom, Murdock had begun lighting buildings by gas, Cort had invented the puddling furnace and the rolling mill, and Tennant had produced chloride of lime and applied it to bleaching purposes—a prominent scientist said that there could be no probability that the next age would advance as rapidly as that had done. But discovery has followed discovery in a geometrically progressing ratio, until, at the present time, we stand aghast, and say, "What can come next?" It is, however, probable that the future will bring many a discovery and application of knowledge, as far beyond anything we can now imagine, as sewing machines and mowing machines, railroad and steamships, celluloid and dynamite, rock drills and rotary printing presses, vulcanized india-rubber and Bessemer steel, boring for oil and burning water-gas, photography and the phonograph, electric light and electric smelting, the telegraph and the telephone, the spectroscope and hundreds of other discoveries and inventions of the Nineteenth century, were beyond the thoughts of our grandfathers one hundred years ago.

But though we cannot foretell what wonderful things may be in store for us in the future, we may at least speculate a little, based upon the knowledge we now have. I have spoken of the probable exhaustion of our coal fields and the necessity of finding some substitute. There is a source of heat fully capable of supplying all we need, if it can be utilized; that is the sun. It has come to be generally admitted that coal is in a sense nothing but condensed sunlight, stored up in ages past for our present use. Now, if we can only devise means for imprisoning the heat of the sun, so as to use it as we may need it, then we can abandon

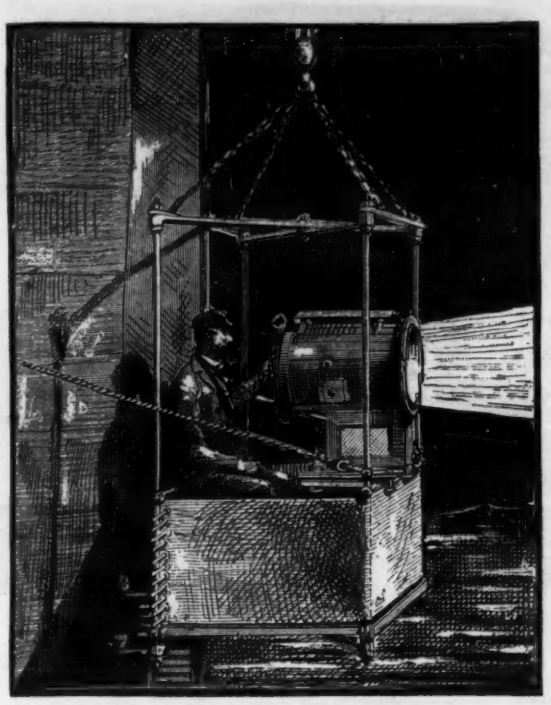


FIG. 2.—NAVIGATION OF THE SUEZ CANAL BY NIGHT.

our coal mines and forget that they ever existed. The amount of this heat in one minute, as determined by the United States expedition to Mount Whitney, is sufficient to heat one gram of water three degrees centigrade for each square centimetre of the exposed surface of the earth. But this conveys little idea to the mind not educated to think in such measures. It may be better understood if we say that it is equivalent to the heat generated by the combustion of, in round numbers, one thousand millions of tons of coal for every minute in the year; or one million three hundred thousand times as much as is now mined.

Already an honored member of our Society, Captain Ericsson, has shown us how a portion of it can be conserved. But the question may be asked, What would be the result upon the condition should this heat, which now goes to warm the earth and promote vegetation, be used for other purposes? To this it may be answered, that, as the earth does not grow warmer year by year, all the heat it receives must either be changed to other forms of energy or be radiated into space. It is likely, therefore, that the heat radiated from the earth is nearly as great as that received, and possibly some way may be discovered to catch it on its outward journey, if it be found that the amount necessary for the purpose would rob nature of her share. But, as the burning of four hundred million tons of coal, and probably as much more wood, upon the earth, per annum, does not seem to perceptibly alter the character of our seasons, it is probable that a similar amount taken from the heat received from the sun would not produce a noticeable effect upon the processes of nature.

But we must learn to conserve our heat better, and instead of the present wasteful mode of making power by

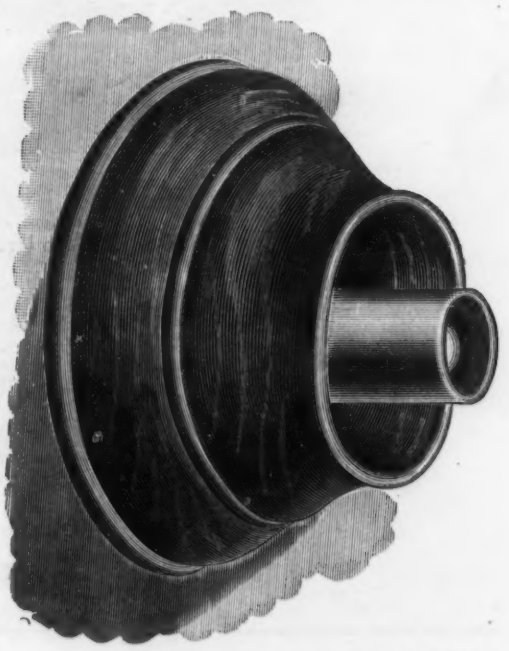


FIG. 1.—THE DENIO THERMOSTAT PUSH BUTTON.

means of steam, by which only one-tenth of the heat generated is utilized, some better means must be discovered of turning heat into work. The generation of electricity directly by the combustion of coal has often been suggested as a possible thing, and one of our members, Mr. Edison, is even now working with some success upon the problem. Should future genius succeed in utilizing the heat as fully in a thermo-electric generator as is now done in our steam boilers, the coming age will get its power at one-fifth the cost of the most economical engines of this day, and then, if the radiant heat of the sun can be caused to take the form of electrical force, factories, railroads and steamships will be driven and lighted with no expense beyond the interest and wear and tear of the machinery.

It is not, however, necessary for us to wait for the discovery of this efficient thermo-electric generator before we can conserve our fuel. We now have means by which the water power, which is going to waste, can be transmitted to localities where more power is demanded. Electric dynamos have attained to as high as ninety per cent. efficiency, and if they can be made perfectly reversible, which, at least, seems probable, we should be able to transmit power with comparatively small loss. The water-power of the world is estimated at two hundred million horse-power, and when we shall have conserved this we shall have enough to supply the world's work for years to come; then there is the enormous energy of the tides and of the winds, which might be added thereto, when we have perfected storage batteries, so that the extremes of effort of such forces may be graded down into a constant mean.

In looking about for fields to conquer, the question springs to the mind, Shall we ever fly? That has been one of the dreams of mankind from the earliest ages. He has looked upon birds as they have sailed through the air, apparently without effort, and has wondered why he could not attain the same mode of motion. Why not? It is simply the question of sufficient power within a given weight. The weight of our steam engines per horse-power has been decreased thirty-seven per cent. in the last five years, and we are not at the end. We are also reducing very rapidly the weight of our dynamos and electric engines in proportion to their power, so that it is now but one quarter of what it was five years ago. When man has learned to generate power with say one-tenth the weight of apparatus that is now required, then, by making the framework of his flying machine of aluminum tubes, there is no good reason to doubt that he will become master of the air, as he is now master of the water, and will be able to fly from place to place with all the certainty and safety of a bird.

But I will not detain you by any further speculations as to the future triumphs of our profession. That they will be great does not admit of a doubt in view of the past. That they will be more wonderful and important than we can now comprehend is probable from the analogy of history. That they will elevate and ennoble man, lift him out of many of his present limitations, and make him the master where he now is the victim is certain, because that has always been the effect heretofore, and because it is the end for which the engineer is commissioned. This society is to be a factor in such result. Its

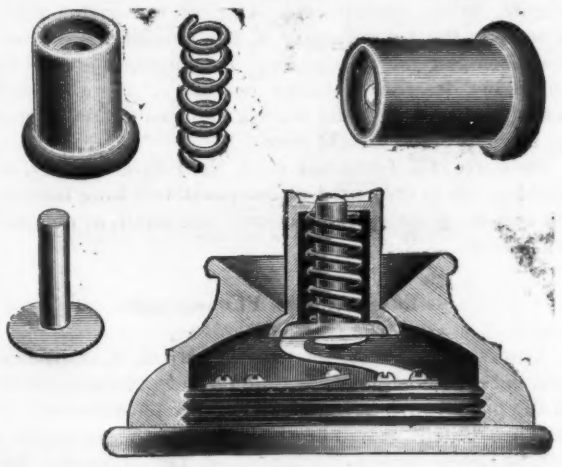


FIG. 2.—THE DENIO THERMOSTAT PUSH BUTTON.

every meeting to mingle experiences, to discuss causes, to compare attainments, and to encourage research, is a step toward the final achievement, when every force of nature and every created thing shall be subject to the control of man.

* Portion of opening address at the meeting of the American Institute of Mechanical Engineers, Philadelphia, Nov. 28 1887.

Navigating the Suez Canal by the Electric Light.

Like many other steamers trading between Europe and the East, the Peninsular and Oriental Company's vessels pass through the Suez Canal, and according to the present regulations they are allowed to steam on at night, instead of being obliged to moor at dusk, if they are provided with search lights. For this purpose the Anglo-Brush Company has provided the apparatus illustrated in the accompanying engravings, Figs. 1 and 2.

It consists of a cage which is suspended over the bows of the vessel and is lowered within 8 ft. of the water. In this cage there is mounted an arc lamp taking a current of 70 amperes and 65 volts. The lamp is regulated by hand by an attendant who sits behind it and feeds the carbons together as they are consumed. The beam is reflected by a mirror 22 in. in diameter and 12 in. focus, and then is spread sideways by a dispersion lens which widens it into a sector subtending an angle of 22 deg. The direct rays of the arc are prevented from leaving the lantern, by a carbon shield, but as the crater is turned towards the mirror there is very little loss from this cause. By the use of this apparatus the time of passing through the canal is reduced from an average of 36 hours to 15 or 18 hours.

Denio's Fire Alarm Attachment.

In hotels and business houses where an annunciator is already in use, it is desirable to have in conjunction therewith a fire detector in each room. In order to utilize as much as possible the existing apparatus, the W. L. Denio Fire Alarm Company, of Rochester, N. Y., have recently brought out an interesting attachment to the ordinary push button, by means of which it is capable of performing the additional function of a thermostat.

The push and fire detector complete is shown in Fig. 1, and Fig. 2 shows the same in section and with the various

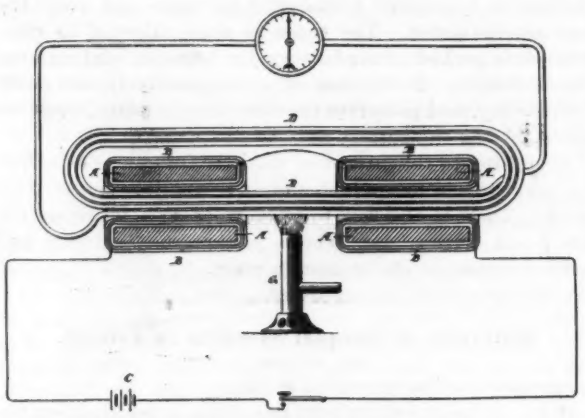
parts in detail. As will be seen the button is converted into a thimble with an internal flange near one end, and an external flange and recess in the flange at the other end. A spiral spring is placed in the thimble and is seated against the flange at the top end. A pin is then thrust through the spring, the pin being provided with a head of sufficient diameter to enter the recess in the external flange end of the thimble. The pin is sufficiently long to project entirely through the orifice in the internal flange end of the thimble. When the parts have been assembled the pin is secured in place by soldering to the thimble and flange as shown in Fig. 2. The solder used for this purpose is one which will fuse at a low temperature, 150 to 160 degrees Fahrenheit.

When the heat of any room reaches a predetermined temperature, the alloy melts and releases the pin, which is forced out of the thimble by the expansion of the spring. The electrodes are thereby brought into contact and the alarm transmitted to a central station, where measures can immediately be adopted for extinguishing the fire. The system can be applied to both open and closed circuit systems. It is also evident that the usual push button can be readily converted into the one just described by merely unscrewing the cap and inserting the fire-detector button in place of the old one.

Acheson's Cal-Electric Generator.

In our last issue we described several forms of thermo-electric generators designed by Mr. Edward G. Acheson, of Pittsburgh, in which was employed the principle of the generation of an electric current by the difference of potential created by the unequal heating of the different parts of a conductor.

The latest type of electric generator constructed by Mr. Acheson is based upon an entirely different principle, namely, that if a magnetic whirl is produced in or about an electric conductor, which is traversed by currents of heat, an electric current will be generated in the conductor at each establishment and disestablishment of such magnetic whirl cutting the conductor.



ACHESON'S CAL-ELECTRIC GENERATOR.

Mr. Acheson has employed various means for producing these whirls, and among them the arrangement shown in the accompanying illustration. A cylindrical core *A* of iron or other magnetic metal is wound with coils *B*, the terminals of which are connected to some generator *C* of electricity supplying an alternating, intermittent or vibratory current. Through this coil is passed the conductor *D*, forming the generating or converting coil, the terminals of which are connected to a working circuit, and means are provided for causing heat currents to traverse the conductor—as, for instance, a gas burner *G*. If, now, the electric current is closed through the convolutions *B*, a magnetic whirl is produced, cutting the conductor *D*; and if at the same time heat currents flow through the portions of the conductor within the influence of the whirls an electric current will be generated in the conductor at each establishment and disestablishment of the whirls, and a conversion of the heat currents into electric currents takes place in the conductor.

According to Mr. Acheson the best results are obtained by causing two magnetic whirls around the conductor with the direction of the lines of force in opposition; and by locating the source of heat between the whirls, so that the heat flows from a central point in opposite directions, as shown in the illustration, the direction of the lines of force of the whirls with relation to the direction of the heat-currents will be such as to convert the heat currents into electric currents of the same direction.

An Error Pointed Out in a Book.

To the Editor of The Electrical World:

SIR: In the book entitled "Electrical Units Popularly Explained," on page 22, it is stated that a watt is $\frac{1}{746}$ of a horse-power, and on page 29 I read that a dynamo which requires 10 horse-power to drive it takes 7,600 watts. That would make a watt $\frac{1}{760}$ of a horse-power. Which is right, that on page 22 or page 29? A. J. BRADFIELD.

ROCHESTER, N. Y.

ANSWER.—The statement on page 22 is correct. That given on page 29 is evidently due to an oversight.—EDS. E. W.

The Patten Electric Motor.

We illustrate on this page an electric motor of novel construction invented by Lieut. F. Jarvis Patten, U. S. Army. Its novel features consist mainly in a new system of armature winding, commutators and connections, as well as some mechanical details worthy of notice. In the accompanying engravings, Figs. 1 and 2 are side and end elevations of the motor, half of each being shown in section.

A noticeable feature of the machine is an exceedingly

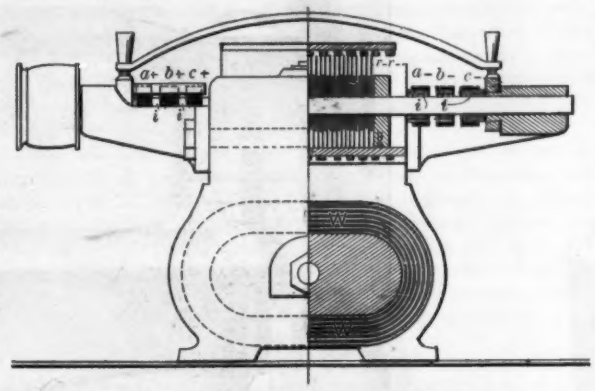


FIG. 1.—PATTEN'S ELECTRIC MOTOR.

short magnetic circuit and a slightly unsymmetrical field, the purpose of which will be explained later. The motor has a comparatively large proportion of iron, a single magnet core and coil forming the yoke of a very short and stout electro-magnet, thus bringing the centre of gravity of the entire machine to the lowest possible point. To the core there is bolted by a single transverse bolt the two curved pole pieces of cast-iron, which are so shaped as to reduce the magnetic lines of force to their shortest length, while the armature fits so closely that there is but $\frac{1}{32}$ of an inch of air space in the magnetic circuit.

Secured to the spindle is a three-coil armature of peculiar construction. The coils are wound longitudinally around three poles, radiating at angles of 120 degrees from the spindle. The armature may therefore be regarded as a drum armature with three coils and a minimum amount of inactive wire, the ends being shortened in the proportion that the length of a chord of 120 degrees or less is to that of a diameter of the same circle. These three coils of the armature are all continually in circuit in parallel arc, so that the armature consists of a three-coil multiple arc winding, thus reducing materially the armature resistance, as by the peculiar arrangement of the field described none of the coils of the armature are at any time cut out of circuit.

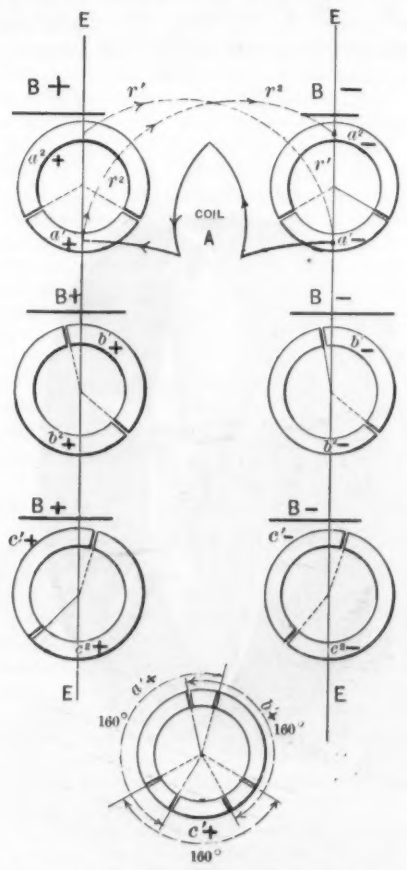


FIG. 3.—PATTEN'S ELECTRIC MOTOR.

This system of construction admits further of a non-sparking commutator for all positions of the brushes, and is the result of the peculiar commutator connections rendered necessary. These are shown in Fig. 3.

As will be seen, there are practically two commutators, one revolving under the positive and the other under the negative brush, and the two brushes are placed upon the same side of the spindle and at opposite ends of the armature. This arrangement, it will be noticed, leaves the entire commutator exposed, so that it can be easily cleaned while the machine is running. In Fig. 3, the vertical lines *E E* represent a vertical diameter of the armature spindle, and each segment of the commutator is shown in its proper relative position thereto. An examination of the diagram of connections will show that each of the three coils is constantly in circuit, and is entirely independent of the other two. The action of a single coil during one revolution will therefore describe that of all. Thus, in Fig. 3, the coil *A* is shown with its terminals connected to two partial commutators, one revolving under the positive, and the other under the negative brush. The coil is secured by one terminal to the segment a^1+, and after traversing the armature has its other end secured to the segment a^1-, which revolves under the negative brush and occupies exactly the same angular position on the spindle as the first segment. This last segment, however, is also connected by a free conductor r^1r^1 back to the second segment a^2+ of the first half commutator; and the segment a^2- of the second half is likewise connected by the free conductor r^2r^2 back to the short segment a^1+ of the first half.

The other coils of the armature are similarly connected to their corresponding commutator segments, the only difference being that the corresponding segments for the different coils are placed in rotation around the spindle so that their middle lines make with each other angles of just 120 degrees.

If now the current be regarded as flowing direct from the positive to the negative brush, and the result during a single complete revolution of the coil *A* be traced, it will be seen that while the short segments a^1+ and a^1- are under their respective brushes, the current will flow direct in the coil *A* from the positive to the negative brush. When, however, the short segments pass out of action the current will flow from the positive brush $B+$, through the long segment a^2+, the free conductor r^1, over to the short segment a^1- (no longer under the negative brush), then back through coil *A* in a reverse direction to the short segment a^1+ (no longer in contact with the positive brush), and thence through the free conductor r^2r^2 to the long segment a^2-, and out through the negative brush as before.

It is therefore plain that the current flows direct in any coil while the short segments are under the brushes, and

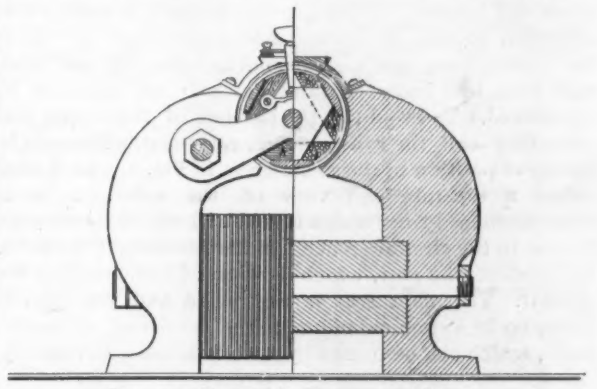


FIG. 2.—PATTEN'S ELECTRIC MOTOR.

in a reverse direction whenever the long segments are in contact with the brushes; and this change takes place alike for each of the armature coils in rotation.

The relative amount of direct and reverse current taken in a revolution by each coil will depend upon the relative amount of the spindle circumference covered by the long and short segments, and this must necessarily depend upon the amount of distortion or unsymmetrical arrangement of the field, which, for well-known reasons, must have comparatively narrow limits. This distortion of the field amounts practically to changing the diameter of commutation from a right line (diameter) to a broken line, consisting of two radii meeting in the centre of the spindle, an effect involving, it is claimed, no disadvantages under the conditions as secured and provided for, viz., that both brushes are on the same side of the spindle.

If now the further condition be borne in mind that the coils must of necessity radiate at equal angles of 120 degrees from the spindle, and we give to the field poles a relative position, as shown, such that the points on the armature circumference where the current must change direction are at the extremity of radii that are inclined at some angle between 140 and 160 degrees, it will result in giving to the armature a continuous unbroken circuit, and as the three coils are always in parallel arc, there can be no short circuiting of the coils due to the brush bearing upon two different segments simultaneously.

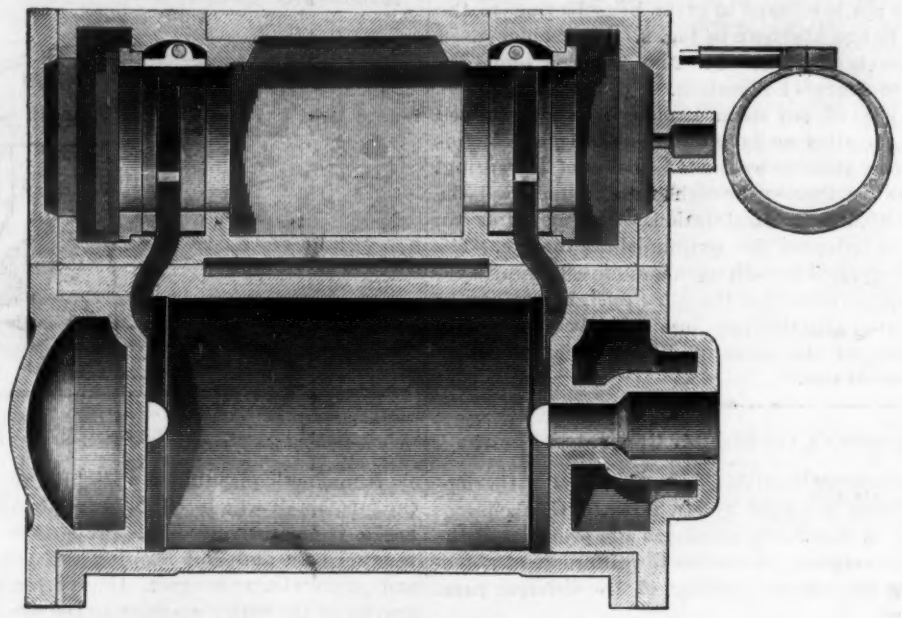
This effect is shown by the lower diagram in Fig. 3, in which the short segments are shown as covering arcs of 160 degrees each of the spindle circumference. Any two successive ones must, therefore, overlap by an angle of 20 degrees, from which it results that there is no point during a complete revolution at which the armature circuit is broken. For, as the current changes from any one coil at any point, there are two others in contact with the same brushes that form a continuous circuit. The resultant effect amounts practically to making a set of commutator segments that cover $3 \times 160 = 480$ degrees, each single part overlapping the other by an amount equal to $\frac{1}{3}(160-120) = 20$ degrees.

Another result of this peculiar form of armature construction is the complete elimination of a dead centre, there being at all points of a single revolution a continuous rotary torque, which may be expressed as the resultant effect of three separate tangential efforts which can never be so placed as to neutralize each other.

A New Electric Light Engine.

In the operation of an electric light plant, the question of power is always one of prime importance, and any advancement in steam engineering helps toward the universal adoption of electricity for lighting purposes.

Messrs. McIntosh, Seymour & Co., of Auburn, N. Y., have recently equipped extensive shops for the manufacture of steam engines especially designed to drive dynamos. The general design of the engine built by them is illustrated in the accompanying engraving, Fig. 1, and it possesses a number of improvements worthy of description. The bed resembles the Porter-Allen type, but has an improved system of internal ribbing, making it very strong and heavy. The lower guides are separate pieces resting upon planed surfaces on the bed. This prevents the alignment of the engine from being disturbed by wear or injury to the guide-bars, which can be renewed or adjusted at any time without disturbing the bed. Both



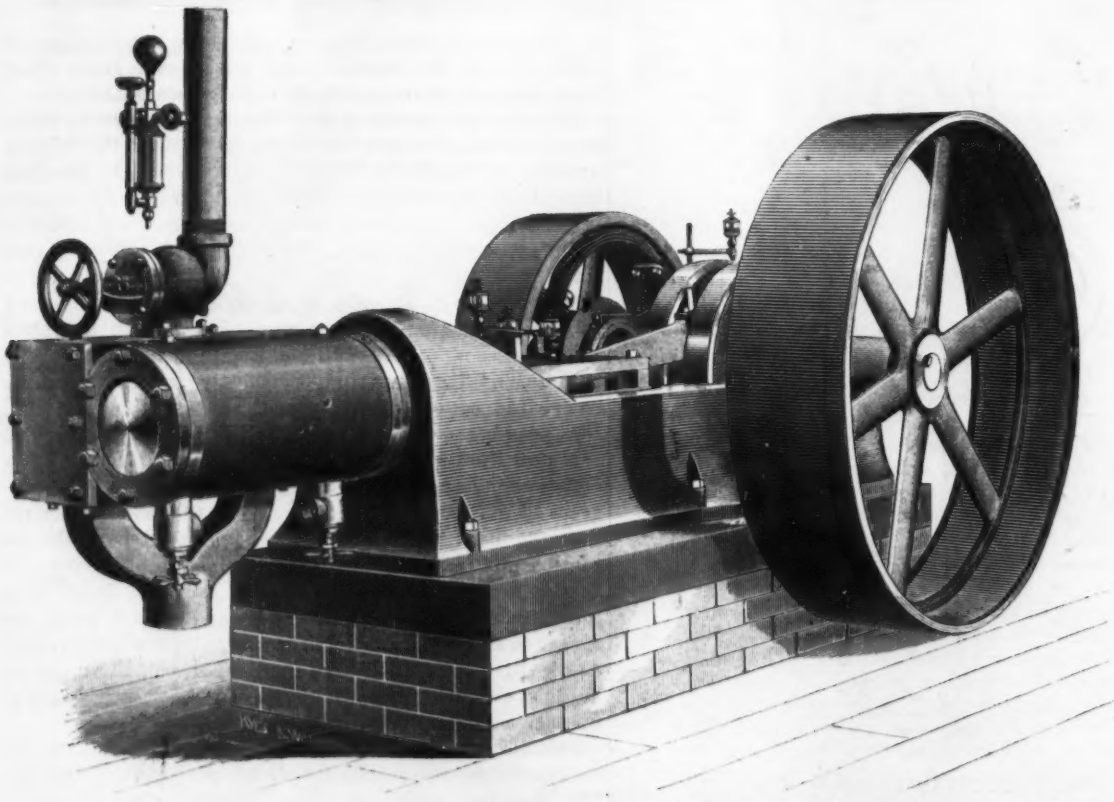
FIGS. 4 AND 2.—THE McINTOSH & SEYMOUR ENGINE FOR ELECTRIC LIGHTING.

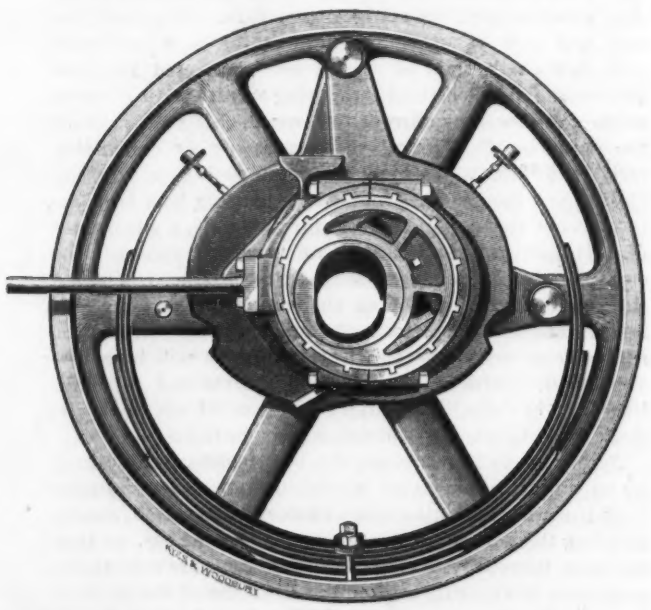
cylinder heads have ground joints and enter the cylinder for a considerable distance, making the ports direct and the clearance small.

The valve and governor present features of especial interest and novelty. A simple piston valve is used. The objection to this otherwise most perfect form of valve has always been that wear cannot be taken up and that they soon leak badly—a fatal defect when economy is considered. To avoid this the builders of this engine use what they call their adjustable valve-seat. This seat is shown in position in the steam chest in Fig. 2, which also shows a separate end view of the valve. It is a crescent shaped ring, which is split and has the port opening cut in the circumference. It fits steamtight between the sides of the port, which is widened sufficiently to receive it. This split seat is contracted and the wear is taken up by a stem extending to the outside of the steam chest, which can be turned by a wrench and is covered by a cap when not in use. While moving the valve by hand by disconnecting the eccentric rod and grasping the valve-rod slide, it is a very short and easy matter to adjust the seat to fit the valve exactly. Actual experience with the working of this valve has shown that by thus following up the wear occasionally any sensible loss by leakage can be entirely obviated.

Fig. 3 shows the governor, and Fig. 4 the shifting eccentric in detail. It belongs to the class of governors that regulate the speed of the engine by automatically varying the cut-off, which is done by shifting the eccentric across the shaft. The eccentric is attached to a pendulum so pivoted that the lead remains constant while the cut-off can vary from zero to five-eighths.

In this governor the movement of the pendulum is effected by weights having inclined jaws attached to them, in which slide blocks that turn freely upon a boss upon the pendulum. The centrifugal force of these weights is directly opposed by a double plate spring through hardened steel pins, one end of each pin resting in a hardened cup on the spring, and the other in a slot in the weight. Should the speed of the engine tend to increase, this centrifugal force overcomes the resistance of the springs, the weights move outward and the inclination of the jaws upon them shoves over the pendulum, thereby reducing the cut-off, and hence the amount of steam supplied to the cylinder; and *vice versa*, if the speed tends to decrease. These jaws have a locking effect upon the eccentric, which relieves the weights of all thrust from the motions of the valve and its driving gear. This removes entirely the chief cause of "racing." The best material is employed in the manufacture of the engine, and lubrication, so necessary for continuous operation, has been amply provided for. These engines are in use in a number of electric light plants.





FIGS. 1 AND 3.—THE McINTOSH & SEYMOUR ENGINE FOR ELECTRIC LIGHTING.

The Cox Gelatine Battery.

In many situations it is desirable to have a battery which shall be able to withstand violent shaking and jarring without deterioration, and for this purpose a battery devoid of liquid is well adapted. Such a cell has been devised by Mr. Harry B. Cox, of Cincinnati, O., and is known as a gelatine cell.

The process employed by Mr. Cox in the manufacture of his cell has recently been patented and presents several points of interest.

The gelatine is prepared by soaking Irish moss or other sea moss in cold water until it becomes softened by absorption, and allowing it to soak until the starchy matter of the plant begins to ferment or sour. When it reaches this stage a quantity of water, about equal in bulk to the soaked moss, is added, and the whole boiled for from fifteen to thirty minutes. The amount of water may, however, vary according to the desired consistency of the final product. After the boiling a quantity of sal ammoniac or other salt of an alkali is added, sufficient to make the excitant a good electrolytic conductor, and to assist in the exciting action on the zinc, and the mass is then subjected to further boiling. These repeated boilings serve to completely rupture all of the starch-cells of the plant and dissolve the gluten, while the fermentation probably assists in decomposing the cellulose. The material then becomes of a uniform pasty consistency and the sal-ammoniac is thoroughly incorporated and dissolved throughout the mass. The latter is poured into a receiving vessel, and a small quantity of bisulphate of mercury is added. The latter improves the electrolyte by slightly acidulating the same, and keeps the zinc amalgamated. The mass is then allowed to cool, when it is packed in the battery jar between and around the electrodes. It becomes of a comparatively stiff pasty consistency, and preserves the electrodes in place, however much jarring the battery may be subjected to.

According to the inventor, this electrolyte resists low temperatures, a fact which adapts it well for out-of-door work. There is also said to be more or less fermentation going on during use, which preserves acidulation and tends to raise the electromotive force.

Batteries of Unequal Strength in Circuit.

To the Editor of The Electrical World:

SIR: If two or more batteries of the same kind but unequal strengths be united in parallel and open circuit, will the stronger produce a current through the weaker until the strength of the stronger is reduced to that of the weaker; or will the current of the stronger circulating in reverse order through the weaker tend to add to its strength until both are equal; or would all the batteries so connected completely exhaust themselves as I have been told by some they would?

I have in mind, of course, in the above such batteries as will not lose in strength on open circuit where the elements are completely immersed.

DECATUR, Ill. F. S.

ANSWER: Two or more batteries of the *same kind*, that is, of equal E. M. F., no matter what their size, when coupled in parallel will balance themselves, and the action you speak of will not take place. By batteries of "the same kind but of unequal strength," we take it that you mean batteries of the same kind but varying merely in size.—EDS. E. W.

ENGLISH NOTES.

LONDON, Dec. 24, 1887.

The painful impression created by the sudden death of Prof. Balfour Stewart will, we believe, extend to the American Continent, and, perhaps, to all the scientific centres of the world. He was, it may be said, the founder of the system of observation of terrestrial magnetic phenomena; and the directors of observatories now established in all parts of the globe continued to regard him as their head and chief guide. As presiding genius of one of the foremost scientific institutes in the country, and as chairman or president of several other important associations for the promotion of scientific research, Professor Stewart had won for himself the esteem and admiration of all who had the pleasure of working under him, by reason of his uniform kindness and the peculiar fascination of his presence. Not the slightest warning of his approaching end seems to have been detected by his friends; and indeed, although in his sixtieth year, he seemed as buoyant and active when he left Manchester for Drogheda a few days before his death as most men ten years younger. It may surprise some of your readers that perhaps the best known literary work of the lamented professor was one which scientists generally will not reckon as scientific, but rather theological—I mean "The Unseen Universe," of which he was joint author, and the popularity of which among ordinary readers is testified by the twelve editions through which the work has passed in his own country. Prof. Stewart, it need hardly be said, was a profoundly religious man, and contributed much to the Christian Evidence Society. Strangely enough, as some may think, he was President of the Psychical Society (as well as the Physical), the mysterious force of the supernatural world having a strong fascination for his inquisitive and speculative mind, which was singularly free from the trammels of any particular scientific school, and always open to the evidences of unexplained phenomena.

In adopting the powers conferred on them by Parliament the Bradford corporation contemplate, besides lighting the borough with electricity, supplying that commodity for industrial purposes, notably for running the tramcars. There is a large field open in this country for electrical locomotion, the capital invested in tramways alone amounting to over £13,000,000, the horses numbering 25,501 and the locomotives (for steam trams) 484. The greatest obstacle to the introduction of electric tramcars has been the imposition of restrictive and onerous conditions by the local authorities, who, acting in the spirit of the fatal Electric Lighting Act, have grown more and more opposed to granting monopolies, except for short periods, and then only on terms which mean confiscation. But of the 886 miles of tramways in the United Kingdom, 232 are the property of local authorities; and if they can be induced to adopt electricity for lighting purposes, we may confidently expect that they will utilize this motive power for working their own tramlines. There is still, however, great room for improvement here in the electrical and mechanical arrangements of the tramcars worked by electricity, in fact, they can hardly be said to have passed the experimental stages of development although several are running very successfully.

The year is closing with greatly improved trade prospects, and we hear from all quarters that electric industries are partaking in the general activity, electric lighting orders especially never being so brisk as they are just now. One would have hardly suspected, however, that money was so plentiful as to justify the payment of thirty thousand pounds sterling for a "patent electric bell and signal system;" yet this is what is proposed in a prospectus just issued for the working of "Jensen's" system, with a capital of £100,000. Seeing that every working electrician in the country can manufacture and fit up any kind of electric bell or signal that can conceivably be needed, the prospects of Jensen's subscribers are exceedingly visionary, whatever his invention may be. The patent, however, seems to have been secured (and worked?) in America, and perhaps you may think better of it than we do.

The fresh attempt now being made to light the central part of the city by electric light is meeting with considerable opposition among members of the corporation, ostensibly in the interest of economy, but really in the interest of the gas companies, which in London are an immensely powerful body. We are by no means sanguine on the point; nor are we sure that the City is the fittest area of the metropolis for a renewal of the experiment, that locality being deserted and the shops closed at a very early hour in the evening, usually by 7 o'clock.

In provincial towns, as in the suburban districts of London, the light is making satisfactory converts. Exeter has just been added to the places recently illuminated by means of electricity, and information from there speaks highly of its working; the corporation finding that it gives such satisfaction to the shopkeepers where it has been installed, have already decided to try the experiment for the streets. The system is that of Thomson-Houston.

The project which I see being again revived in the American electrical press for connecting your continent with the far East, by means of a Pacific cable, is one which naturally finds no favor here. The scheme, if successful, would no doubt injure the business of the British cable companies, whose numerous routes to that part of the world are fed to a considerable extent by traffic from across the Atlantic. This fact may no doubt warp the judgment of the proprietors in considering the feasibility of a Pacific cable, but it should be borne in mind that cable laying, so far, has been done almost wholly by British hands, and that the practical experience they have gained entitles them to be heard on a project of such magnitude and financial importance. The proposed route is well known, and the opinion of every expert on this side of the water is decidedly adverse to an experiment so hazardous. It is known that the depth of water is in places so great that probably no cable could be safely laid there and could certainly never be picked up if broken. Moreover, the geographical features of the island groups where it is proposed that any Pacific cable should touch have already been pronounced highly unfavorable for cable landing. I repeat these opinions for what they may be worth, but they are freely expressed in this country. It is pretty certain—I may say absolutely certain—that no British government subsidy will ever be given to any cable of that kind, however much it may be desired as an alternative route in time of war.

A similar adverse verdict is pronounced on the idea lately ventilated in the United States for the purchase or institution of a national telegraph system independent of the companies. A State telegraph monopoly is a practical, and indeed, under certain conditions, a highly advantageous arrangement; but for a State to compete with private undertakings strikes the English mind as an incredible proposition. Seventeen years ago the British government bought up all the existing companies and took over their plant and servants. The service has become very cheap and very popular; it is admirably worked, and is considered the fastest and cheapest telegraph system in the world. But it has never paid, and the competition of the telephone which has been allowed to creep in by paying a small royalty is rendering the financial prospects of the Post-Office telegraphs more gloomy than ever. If the United States buys out the telegraphs it must not forget to buy the telephones as well; if it buys neither, but starts a telegraph of its own, it must remember that its most formidable rival will one day be the telephone.

The annual soirée given by the President of the Society of Telegraph Engineers and Electricians was held on Thursday last at the Institute of Painters in Oil Colors, in Piccadilly. There was a large and brilliant gathering, the guests being received by Sir Charles and Lady Bright. The pictures on the walls, the music of the band of the Coldstream Guards, together with the claret cup and ices, to say nothing of the numbers of distinguished and interesting members of the society who were present, combined to make a most enjoyable evening.

It seems not unlikely that the next practical discovery of overwhelming importance to the electric light industry will be that of a method of making incandescent lamps which will burn without vacuum. This is a result which is surely not impossible of attainment. It means, of course, the discovery of a conducting material of high specific resistance, but of an unoxidizable character, and we may venture to expect that a lamp which would burn without a vacuum would also burn, barring accidents, without the destruction of the filament. Such a lamp would change the whole condition of the incandescent lamp trade, and doubtless there are large numbers of individuals who devoutly pray that such a consummation may never be attained. It happens, however, that there are in this country, as doubtless, also, in your own, men who are devoting a considerable amount of talent, skill and money to the solution of this problem, and although nothing has yet transpired to lead to the belief that the problem will receive an early solution, yet as a matter of fact it may be stated that one of the intermediate steps which has long baffled the endeavors of the investigators has quite recently been attained. You may look forward with some confidence to hearing more upon the subject within, say, the next twelve months.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Jan. 3, 1888.

The United States Illuminating Company has just declared a quarterly dividend of 2½ per cent.

The United States Electric Lighting Company has completed its new lamp factory in Newark, N. J., fronting 135 feet on Orange street and 125 feet on Plane street. It is four stories high, and has a 12 foot basement, which is used for the heavy machinery, engines, dynamos, air pumps, etc., for exhausting, and force pumps for the glassworkers employed in sealing the lamps. The laboratory is on the first floor and is fitted out with a complete line of test instruments, some of the most delicate of which are made by the company's own experts. The upper floors of the building are devoted to exhausting, testing and finishing the lamps. The elevators, stairways, wires, etc., are all in separate compartments outside the building. The company is at present about 100,000 lamps and 120 machines behind its orders. In New York city it has recently been engaged fitting out the Metropolitan Life Building in Park Place and the American Tract Society's building at the corner of Nassau and Spruce streets. The Equitable Building will put about 5,000 lamps into operation about Jan. 1, and the Philadelphia Post Office starts up with 2,500 about the same time. The Troy Electric Light Company makes a large increase, as do also the Rochester and Newark companies, and altogether about a score of new stations have been started in the last three months. Among isolated plants may be mentioned Folwell Brothers, Philadelphia, with 600 lights; Patterson Mills, Chester, Pa., 600; B. Solomon Sons, Philadelphia, 350; and the New Kenyon Building, Kansas City, 750. A new machine of 80 volts and 70 ampères has been sent to Bethelehem, Pa., for charging accumulators, and United States machines are also being similarly used at Allentown, Pa., Honesdale, Pa., Watsontown, Pa., and other places.

B. W. Payne & Sons have supplied, recently, for the Edison plant at Cooperstown, a 90 h. p. horizontal steel tubular boiler; two 125 h. p. boilers for the Edison station at Troy, and a 25 h. p. engine, 8x10, for the Park Central Hotel at Hartford, Conn., using the Sawyer-Man system.

Buehler & Bateman, Edison agents, have installed a plant for the American Express Company's offices and stables, near the Grand Central depot. It includes a 600-light machine. Mr. J. H. Swinerton, general superintendent of construction and building for the express company, is putting in with the plant a set of 52 cells from the Electrical Accumulator Company. Buehler & Bateman are now wiring the down-town stables of the company.

Mr. C. A. Benton, the New York Edison agent, has just completed a plant of 300 16 c. p. lights for the new pier of the Ocean Steamship Company. The outside circuit includes two Simplex lamps. Power is obtained from a New York Safety engine 10 x 12. The pier is 600 feet long, with lamps running alternately 6 and 12, with reflectors. The steamship company is so pleased that it has in view another plant for its Boston pier. It is contemplated to introduce Sprague motors to work on the traveling cranes which transport freight from one part of the pier to another.

Mr. W. F. Swift has taken offices for the Brush Electric Company at 36 Union square, where the business of the company for this large and important section of the country will hereafter be conducted.

An exhibition of the Lahmeyer incandescent machine is being made at the salesrooms of the Otto gas engine, 18 Vesey street, by Mr. E. Imhauser, of 206 Broadway, who has the patents and all the interest in this dynamo in America for sale. The machine is driven by a gas engine and runs 50 lamps of 16 c. p., 110 volts.

The Baxter Electric Manufacturing and Motor Company, of Baltimore, with a growing business all over the country, have found it necessary to increase their facilities, not only for manufacturing, but for dealing with their customers. They have recently opened offices in Boston, and they have now moved into fine, large offices here, in the Potter Building, rooms 347 and 349. The offices are admirably located and are destined to become the headquarters of large motor interests. Mr. T. McCoubray, Jr., who represents the company in this territory, has already succeeded in doing some good work, and the indications on every hand are that he will find his time fully occupied in taking and filling new orders during 1888. The Baxter motors now in use in New York are well reported on, and Mr. McCoubray is determined to put them in wherever an opportunity offers.

I note that the New York *World* of the 1st inst. gives a large cut of the new factory of the Consolidated Electric Light and Sawyer-Man companies at 510-534 West Twenty-third street. The building, bought for $263,000, is six stories in height and covers thirteen city lots. It will have, it is said, when fully equipped and running, a capacity of 10,000 lamps a day. The article pays a merited compliment for their hard work of the past to Mr. H. R. Garden and Mr. H. C. Davis, and goes on as follows: "The recognition of the Sawyer-Man patents naturally brought about a combination of interests of leading corporations, in which the best elements have concentrated around the Consolidated Company, and we consequently find a board of management thoroughly equipped for the vast business of the future. It consists of Mr. George Westinghouse, Jr., president; Mr. H. R. Garden, vice-president and head of the legal department; Mr. Henry C. Davis, secretary, treasurer and general manager. The officers of the Sawyer-Man Electric Company are: Mr. Henry C. Davis, president, and Mr. H. R. Garden, vice-president; and the boards of directors and executive committees of the two companies are composed of the above-named gentlemen and Messrs. Jacob Hays, of New York; Charles H. Banes, of Philadelphia; Thomas B. Kerr, of Pittsburgh; Albon P. Man, of New York; and Mr. Amos Broadnax, of New York, the untiring attorney, who has ably seconded the efforts of Mr. Garden and the officers in winning success for the Sawyer-Man patents. Mr. John M. Roberts is superintendent of the manufacturing department. At the general offices in Twenty-third street, above described, will be found the offices of the Consolidated Electric Light Company, the Sawyer-Man Electric Company, the Westinghouse Electric Company, the Thomson-Houston Electric Company and the Marr Construction Company, the New York office of Prof. E. J. Houston, of Philadelphia; the up-town office of Mr. Frank L. Pope, of New York, and of other scientific experts for these companies, and a laboratory in which everything new in the incandescent field which is worthy of investigation will be thoroughly examined and tested for practical use."

Charles A. Schieren & Co. report sales of leather link belting during the past week to the following parties, for use on dynamos: Edison Electric Light Company, Philadelphia, Pa.; Edison Electric Light and Power Company, La Crosse, Wis.; Clark Electric Company, 43 Duane street, N. Y. City; Plainfield Electric Light Company, Plainfield, N. J.; Valley Worsted Mills, Providence, R. I.; M. D. Moore's Sons, Lowville, N. Y.; Sanford Light and Motor Company, Sanford, Me.

An interesting exhibit of the Geneva non-magnetic watches is being made in the windows of the jewelers, Benedict's, down-town, and Starr's, up-town. The watches in each place are shown hung like charms around C. & C. motors in operation, or else placed on large permanent magnets. While in such positions, whether in the nearest approach to the field of the motors or in absolute contact with the magnets, the watches go on ticking serenely and steadily as though no such potent disturbing influence as magnetism were ever known or heard of. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Jan. 1, 1888.

Mr. Frank W. Harrington, of the Western Electric Company, was in this city last week.

The Baxter Electric Manufacturing and Motor Company, of Baltimore, Md., has established its New England branch at No. 178 Devonshire St., Boston.

Mr. W. C. Hibbard, the well-known manufacturer of electrical apparatus and supplies, Montreal, Canada, reports business in his line as being active, and the demand for electrical goods and electric lights in Canadian cities and towns as being on the increase.

Hon. James Russell Lowell in making the opening after dinner address at the tariff reform dinner at Hotel Brunswick, Boston, on Thursday evening, Dec. 22, made the following reference to electricity to paint his rhetorical picture on the work of patriotism: It is this more modest and thoughtful patriotism to the exemplifying and practice of which we aspire; and the first lesson it teaches us is that a moderated and controlled enthusiasm is, like stored electricity, the most powerful of motive forces.

The Electric Gas Lighting Company, of Boston, is much elated over its receipt of the highest prize given by the American Exhibition, London, England, which was awarded for the company's display of electric gas lighting apparatus, the "Tirrell" gravity drop annunciator and burglar alarm, and its "Victor," "Hub," and "Standard" electric bells. The exhibit was planned and arranged by the English agents of the Electric Gas Lighting Company, the Woodhouse & Rawson Electrical Supply Company, of London.

The Thomson-Houston Electric Company is making installations of its systems of arc and incandescent lighting at Orange, Mass., and Ware, Mass. The same company has received an order from the Brattleboro', Vt., Gas Light Company for a complete equipment for a plant of 50 arc lights.

The Sawyer-Man Electric Company's New England agency (Mr. P. H. Alexander, Manager) has made the following installations recently: 75 incandescent lights at the Harvard Mills, Watertown, Mass.; 300 lights at the mills of the Westbrook

Manufacturing Company, Sacarappa, Maine; and 163 lights at the factory of the Everett Piano Company, Boston.

Mr. H. C. Buck delivered a very interesting lecture on the history and progress of electric lighting before the Science Class at Parker Memorial Hall, Boston, on Sunday, December 25. Illustrations were given upon the blackboard of the distinctions of the different batteries and systems at present in use, and of the modifications through which the results attained have been reached, with an account of some of the difficulties still to be overcome in the application of electricity to lighting and the mechanic arts. The lecturer gave also a description of the welding of iron by electricity, which Professor Thomson had exhibited within a day or two in his presence. This application of electricity promises to be of the greatest use in mechanic arts, because of its economy of time and power.

The Thomson-Houston Electric Company is in receipt of orders daily for its alternating system of incandescent electric lighting. In conversation with one of the officers of the company recently, I was informed that "complete equipments of apparatus for the distribution of energy for lighting by alternating current, including dynamos, of capacity from 250 to 1,000 lights, the necessary transformers, potential and current indicators, together with a complete system of feeder boxes, junction switches, and all other devices necessary can be had at short notice on application at the executive offices of the Thomson-Houston Electric Company, No. 178 Devonshire street, Boston, Mass." The induction or alternating system solves completely the problem of domestic lighting; distributing as it does the current at a high electrical pressure to the points where it is to be consumed, and converting it to a low tension at this point.

The effect of the "Copper Corner" on the large brass factories of Waterbury, Conn., is comprehensively explained in a special dispatch to the Boston *Herald*: It is estimated that upward of 30,000,000 pounds of copper are used in Waterbury in one year, and the rise in the price is of general interest here. At Benedict & Burham's, the largest brass concern in the country, E. L. Frisbie, Jr., says: "I understood from those on the ground that the fire in the Calumet & Hecla mines would not reduce their output more than one-third. There are two or three other shafts that have not been worked to the fullest capacity. Of course, the chief cause of the rise of copper from 10½ cents to its present price of 17½ or 18 cents is due largely to the manipulation of the syndicate. It is impossible to say just who compose the syndicate, but it wouldn't be strange if the Rothschilds were behind it. It is also surmised by some that Spaniards are in the ring to cut down the production of the Chili mines. The chief effect of the rise is seen in the small orders that come. Concerns that were wont to buy three and six months ahead, buy now for only a few weeks ahead, and they buy pounds where they bought tons. The reason is that they have a hope that there may be a break in the market. Were it certain that the price would remain up where it is, business would go on as before. It is possible that in some business the cheaper metals may be substituted for copper, yet not to any very great extent, unless with telephone and telegraph wire makers. If the price remains up, Waterbury industries will naturally be affected to the extent that they will turn out less work, unless, of course, the price becomes stable." Matthews & Willard, the Scovill Manufacturing Company and Randolph & Clowes confirmed all Mr. Frisbie said about the effect on manufacturers. Orders have fallen off about 50 per cent. These concerns, which consume about 2,500,000 pounds a month, will not be in the market for copper for 60 or 90 days, if the price remains where it is. Some of the concerns will close down some departments rather than order at a sacrifice. The only prospect for a break in the market, in their opinion, is that the market may become glutted through increase in production and decrease in consumption. The time was when these concerns could dictate the price of brass to the world, but now there are so many small concerns scattered about that that is rendered impossible. Nevertheless, their action must have some effect on the course of the syndicate.

The Schuyler Electric Company, of Middletown, which recently purchased the entire plant of the Schuyler Electric Manufacturing Company of Hartford, has fitted up its new factory in a most complete manner. In addition to the Harris-Corliss steam plant it has put in a 125-h.-p. Russell engine, boilers, etc. It also has purchased a large amount of machinery through the Prentiss Tool Company, of New York, and proposes to make still further additions. The new Schuyler factory at Middletown, Conn., comprises five large buildings, four of brick and one of wood, the main building being four stories in height, and admirably adapted for the new business. I expect for the new Schuyler Company as successful a business as its predecessor had before its late president joined the American colony in Canada. It seems to be rapidly getting to itself its share of the electrical business. It has recently sold a 50-light plant to the Mission Ridge Land Company, of Chattanooga, Tenn., which is intended to light the new settlement at East Lake. This sale was one of the good results from the excellent display made by the Schuyler Company at the Piedmont Exposition at Atlanta, Ga., where it took the first prize over all competitors.

The Schuyler Company has also sold a 15-light arc plant to Messrs. Gordon, Strobel & Laureau, of Philadelphia, which is giving most satisfactory results. Manufacturers are rapidly getting to recognize the fact that more work can be obtained from their men when their factories are lighted by electricity than when lighted in the old way by gas. Messrs. Wickes Brothers, of East Saginaw, Mich., the large manufacturers of gang saws and lumber machinery, have put in a 20-light Schuyler arc plant and do not hesitate to say that it gives most perfect results and saves them money. The Clinton (Mass.) Gas Light Company, using the Schuyler system, has decided to put in the Brady mast arm, and the first invoice was shipped last week.

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., Dec. 31, 1887.

The question of electric lighting for this city for the year 1888 has caused more discussion in City Councils this year than ever before, on account of the claim that the city was being charged high prices for the service by the companies which compose the Electric Trust, and the time when the matter of appropriating money and awarding contracts for this service should come up has been awaited with much anxiety.

When the bids were opened last Saturday it was alleged that the four leading electric light companies had made a combine, and they had farmed out the city to suit themselves, and thus maintain the present prices that the city has been paying for this service.

It has long been known that the various electric lighting companies in the city had been formed in a pool under the name of the "Electric Trust." The Keystone Light and Power Company is the only concern in the city proper that has not gone over to the Trust, and its bid was the only one opened that had been offered, it was claimed, with the view of honestly competing for the city's business.

The prices offered by the companies in the Electric Trust showed an average reduction of about 4½ cents per lamp per night, which means an annual saving to the city of about $8,200 on the lamps now in service.

The bids were opened by Director of Public Works Wagner in the presence of the Electrical Committee of City Councils. After the bids had been read Select Councilman Freeman said to General Wagner: "In view of the statements made recently by President Lawrence, of Common Council, that the city of Philadelphia is paying too much for its electric lighting, I suggest that the Director postpone the award of the contract until the matter can be looked into." The Director accordingly postponed the awards until Tuesday.

The names of the bidders, the territory they offered to light and the prices per lamp per night are as follows:

Brush Electric Light Company, Thomas Dolan, President—South side of Market street to the north side of Spruce street, between Delaware and Schuylkill rivers, 47½ cents; present price, price, 52½ cents.

South side of Spruce street to the north side of Washington avenue, between the two rivers, 50 cents; present price, 52 cents, and a few isolated lamps at 62 cents.

Below and including the south side of Washington avenue, between the two rivers, 54 cents; present price ranges from 52 to 62 cents.

West of Schuylkill River, 50 cents; present price, 55 cents.

North side of Market street, west of Broad, to the south side of Callowhill street, 47½ cents; present price, 50 cents.

Philadelphia Electric Light Company, Henry Lewis, president, No. 1,116 Noble street. West from the east side of Broad street and north from the south side of Callowhill street, 47 cents.

North from the south side of Callowhill street, between Broad and Eighth streets, 49½ cents.

North from the south side of Callowhill street, between Eighth and Sixth streets, 52½ cents.

This company is now lighting 100 lamps in this territory at an average price of 52 cents.

United States Electric Light Company, R. H. V. Hill, president. North from the north side of Market to the south side of Poplar street, and east from the south side of Broad street to the Delaware River, 50 cents.

Northern Electric Light and Power Company, William F. Patton, secretary and treasurer—North of and including Poplar street, east of and including Thirteenth street, 49 cents; present price, 55 cents.

Germantown Electric Light Company, George Wayne, president—55 cents; present price, 55 cents.

Frankford Electric Light and Power Company, James Comly, president—Seventeen lights, to burn all night, at 55 cents; present price, 40 cents, but the lamps burn only half the night.

Wissahickon Electric Light Company, James Christie, president—55 cents.

Keystone Light and Power Company, C. H. Jackson, president—Between Walnut and Arch streets, and the Delaware and Schuylkill rivers, 35 cents.

The Keystone Company has no contract with the city at present. It has long been trying to obtain permission from City Councils to lay its conduits beneath the streets in the territory mentioned, but owing to the hostile attitude of the friends of the Penn Electric Light Company the Keystone Company has been unable to obtain the desired franchises from Councils. Now the company will agree to furnish the lights at 35 cents, provided it shall be permitted to lay its conduits in the district or to erect poles, the company to have the right to use the poles or conduits for private lighting; or it will agree to string its wires on the city's poles if it shall be allowed to use the latter for private lighting. The acceptance of the Keystone Company's bid will affect eighty-six lights and result in the saving of about $4,000 per annum to the city.

The specifications require that the lights shall be arc lights of at least 2,000 candle-power, and that they must burn nightly from sunset to sunrise. Lights burning less than eight hours in any one night will not be paid for. No lights beyond the registered capacity of the dynamo shall be attached to the wire furnishing the city lights. The failure of the lights for two nights shall be sufficient cause for the annulment of the contract.

There are now 524 electric lights used by the city. During the coming year there will be 125 new lamps placed in position.

When the Electrical Councils Committee met on Tuesday afternoon to approve of the award of contracts, Director Wagner said that he was inclined to send all the bids to Councils for their consideration.

"I would like to have the opinion of the committee on this question," said General Wagner. "My inclination to have the whole subject referred to Councils is reached after considering the bid of the Keystone Electric Light Company, which offers to light the central part of the city at the rate of 35 cents per lamp, which would make a difference of nearly $100 a day as compared with the price asked by other bidders. My idea is, I say, to refer all the bids to Councils, and in the meantime to ask these gentlemen to continue to light the lamps on the basis of the rates mentioned in the bids. Two of these bids are very peculiar. The specifications call for arc lights of 2,000 candle power. Two of the companies in the rural districts say that they cannot furnish lights of that power, and that no other company in the city has done so."

Mr. Graham—"Do you intend to bring those companies up to the 2,000 candle power?"

General Wagner—"Undoubtedly that is the condition under which they bid. I do not think there is a 2,000 candle-power arc light burning in the city."

Mr. Freeman—"How do you test the candle-power of the light."

General Wagner—"There is a formula for testing lights, and the test is made by the chief of the Electrical Bureau."

Chief Walker said that the actual power of the lights was about 915, although the companies claim to have a 2,000 candle-power light.

Mr. Etting—"I don't hardly understand how, when you advertise for 2,000 candle power, that you consider the bid of a man who says he is unable to furnish a light of that power."

General Wagner—"The fact is that when there is but one bidder, it is simply a question whether you accept the price that is offered. The president of the Germantown Company said that his company furnished a 1,200-power light, and that that was as good as any light furnished in the city. It is the suggestion of the mayor that this whole matter be carried over for ninety days until Councils have had an opportunity to act on the matter. Our purpose is to ask the companies to go on lighting the lamps."

The committee left the matter with the director. The attitude taken by Gen. Wagner was brought about by the conditions under which the Keystone Company bid. They were that the company be allowed time to lay underground wires or be given the use of city poles.

The resolution to inquire as to whether the Edison and Penn electric light companies have merged together in the construction of conduits and laying of wires was referred to a sub-committee.

Mr. Van Dusen made a motion to discharge the sub-committee to whom was referred the ordinance granting the permission to the Keystone Electric Light Company to lay underground wires. He said that here was a company which was willing to furnish light to the city at a saving of $100 a year per lamp, and yet the sub-committee was so derelict that it had never held a meeting to consider the subject. After an explanation by Mr. Wagner the motion was withdrawn, with the understanding that a report would be made at an early day.

The ordinance introduced by Mr. Scott to repeal the underground privileges granted to the Maxim Electric Light Company was considered, and that gentleman explained that the company existed only in name, and therefore the privileges should be rescinded. The matter was referred to a sub-committee, and an ordinance also prepared by Mr. Scott to grant the Brush Electric Light Company additional privileges took the same course. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Dec. 31, 1887.

The Electrical Supply Company have recently placed on the market a new electric light wire, which they call their "P. & B." weatherproof wire. It is claimed that the insulation resistance is excellent, and is not affected by moisture, heat, cold, acid or alkalies.

A proposition has been made to the City of Chicago by Burdett Loomis to solve the gas problem in which that municipality finds itself involved. Mr. Loomis says:

"We propose to organize a company to be called the Mutual Light, Heat and Power Supply Company. We ask from the city a franchise to build and operate gas works to make fuel gas, illuminating gas, furnish electric light and power for electric motors, etc. The company is to be authorized to issue bonds on the work from time to time as the work progresses to pay for the same. The Council shall appoint a Committee on Gas and Electric Light, who shall have the supervision of the works and authority to say when bonds shall be issued to pay for works, etc.

"The company will contract to build works for a certain sum and take bonds as payment, guaranteeing to make a stated amount of gas from the cheap slack bituminous coal. The company agree to make and sell a mixed water gas and coal gas of a quality superior to water gas at prices ranging from 50 cents per 1000 down to 25 cents, according to quantity used. This gas, on account of the coal gas that is mixed with it, will have superior heating qualities and a strong odor, whereby leaks can be easily detected. The same can also be used with incandescent gas-burners for lighting purposes.

"We also agree to furnish incandescent electric lights at a price not exceeding $1 per thousand for illuminating gas. If a proposition similar to the above is accepted we will agree that the city shall have three-fourths of the net profits after paying expenses and interest on bonds, to be placed in a sinking fund to redeem the bonds issued, and when said bonds are redeemed the city is to own the works, and we to have one-fourth of the profits for a term of years to be agreed upon."

Alternative propositions were also made, and the Council Committee, before which Mr. Loomis appeared, were impressed with the views presented, but concluded that it would be better for them to wait until his process was in use in some near locality where it could be seen in practical operation.

The Electrical Advertising Scale Company has recently been organized here, with a capital stock of $50,000, for the purpose of making and selling electric scales for advertising purposes. The incorporators are: H. Burckholder, H. S. Clark and E. H. Dorland.

The Brownell & Wight Car Company, of St. Louis, are putting in an electric plant, so as to operate their works day and night after Jan. 1 to catch up with their orders.

The electric lights along the Chicago River are rapidly being placed in position and the entire one hundred will shine forth in a few days.

Increasing attention is being given to Alderman Clarke's scheme for street lighting, which consists in placing thirty-two candle-power lamps in each lamp post. Professor Barrett will present to the Council at their next meeting estimates as to the cost of such a plant and the expense of running same. Alderman Clarke states that he believes that $150,000 will be appropriated by the Council for this purpose. Several of the members of the Council who were interviewed upon the subject favored the electric light.

The Electrical Protective Supply Company, 171 Randolph

street, are already hard at work. Several outside towns have contracted for this system.

The Railway Telegraph Supply Company are turning out their new vibrating bells by the hundreds. Orders for these bells have been received from large concerns as far east as Boston.

Experiments are being made with a new form of gravity battery by a local telegraph superintendent, with splendid results so far.

The American-Cushman Telephone Company has made a proposition to supply the city with telephones at a lower rate than the local company, if given a franchise.

The Edison central station building is nearing completion.

Many of the supply companies are busy upon their annual inventories.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes me the following quotations upon telephone stock :

Bell of Mo.	$160@$165
Central Union	44@ 45
Chicago	375@ 390
Colorado	19@ 21
Cumberland	62@ 65
Great Southern	30@ 32
Iowa Union	28@ 30
Michigan	73@ 74
Missouri and Kansas	68@ 69
Rocky Mountain Bell	40@ 45
Wisconsin	108@ 109

C. H. M.

CINCINNATI, O., Dec. 26, 1887.

On the occasion of the Annual Christmas Festival of the St. Paul M. E. Sunday School, in Cincinnati, on Christmas Eve, a unique and brilliant feature was devised and introduced by Mr. Robert S. Finch, a young electrician of this city. Thirty-two storage cells were provided, and charged at the works of The Geo. F. Card Manufacturing Company. Eighteen full size incandescent lamps were distributed on the Christmas tree, and burned the larger part of the evening with great brilliancy. The sudden transformation of the tree from darkness to a halo of glorious light was as startling as if the sun should burst into a flood of light at midnight. E. M. F.

SOUTHERN NOTES.

MEMPHIS, Tenn., Dec. 20, 1887.

Business has been very good here this season, and judging by appearances, all the electrical people are happy. The electric light companies, the Brush and Thomson-Houston, seem to be doing fairly well. Their lights are used by many business houses and to some extent by the city for street lighting, although gas is the principal illuminant as yet. Either company furnishes arc or incandescent, although the latter is by no means as plentiful as it should be.

Lowenstein's palatial new dry-goods establishment, just completed, is lighted by incandescent lights and owns its own plant. Leuhrman's Hotel, nearly completed, is being wired for another. The Brush Company have just elected a new president, Mr. Simms, vice Capt. S. T. Carnes, resigned. The Thomson-Houston is under the able management of Major Burke, general manager of the Mississippi & Tennessee Railroad.

The Bell Telephone Company are moving their headquarters to a more desirable location and promise better service in the near future. The new switch-board and other fixtures will soon be in place and a move may be looked for at an early day. They have over 1,300 instruments, with a healthy monthly increase. Mr. Cook is their manager.

The case of the Pan Electric Telephone Company vs. the American Bell Telephone Company was dismissed in the United States Circuit Court here a few days ago. While no business was ever done by the Pan Electric Company, considerable money was invested in a plant. Their central was about complete, lines, poles and cables were all over the city, the sign was painted, the wheels of a mighty concern oiled were ready to revolve, but like a "perpetual motion machine"—something was always lacking—no start was ever made. Now all that remains of the once famous concern is a bright and well preserved sign and "fond recollections" by the old stockholders "of the times that were," and probably some think of "old man" Rogers when they pray. I might add that if the sign had been painted on a board instead of on the building wall, it too might have disappeared, instead of mocking some men who deserved a better fate.

The Western Union Telegraph Company can again safely say, "we are monarchs of all we survey." Their opposition here, owing to poor facilities, never amounted to much. Their business seems to have steadily grown; their facilities have doubled in the last few years. They now employ 55 people, all apparently contented and happy. E. Howard is their manager.

The fire alarm system belonging to the city is being put in much better shape and equipped with improved apparatus, all old boxes especially being replaced by later improvements. Gamewell's system is used.

A new fire alarm system and an electric light company have just started in Jackson, Tenn. I have not yet learned what systems are used. DIXIE.

THE TELEGRAPH.

T. M. B. A.—Assessment No. 213, for January, for $1, covers the death claims of J. T. Honeycutt, F. M. Smith and G. W. Gates. Mr. Honeycutt, who died of typho-malarial fever at Vance, Ala., had not been six months in the association, and was only 21 years old.

The Telegrapher's Brotherhood.—A long article by G. H. Dickinson is published in the Boston *Globe* of Dec. 25, giving details of an interview with Mr. T. O'Reilly as regards the ideas and plans of that gentleman and Mr. Powderly as representing the Telegraphers' Brotherhood and the Knights of Labor in regard to government control of the telegraphs.

The English Channel Cables.—It is stated that the English postal authorities are actively engaged in perfecting means of telegraphic communication between the central office in London and the shore end of the cable from Dover to France. In order to prevent interruption of service by weather, insulated wires are being placed in tubes underground at all the notably weak points in the line between Dover and London. The plans for new arrangements will be carried out during 1888, at the end of which time the service is to become government property.

The New York Bucket Shops.—The New York bucket shops are now engaged in carrying out a scheme intended to get around the law against gambling. They propose to form what they call the "Open Board of Brokers, Limited," and with somewhat grim humor it is provided that the members of the New York Exchange can become members of it on accepting certain conditions, and paying a registry fee of $10.

A Long Streak of Electricity.—The Jenney Electric Company yesterday received a telegraphic proposition from Auckland, New Zealand, which contained seventy words, and cost the sender $2.71 for each word. It is interesting to note the line of travel followed by this message in reaching its destination. The first repeating station was at Wellington, thence to Sidney, Australia, thence across the country to Palmerston, from there via cable to Saigon, Siam, then to Calcutta, thence across Hindostan to Bombay, from there under the Arabian Sea to Mocha, thence up the Red Sea to Mount Sinai, thence across Egypt to Alexandria, then to Palermo; from there under the Mediterranean to Gibraltar, thence to Lisbon, London, Queenstown, New York and Indianapolis. To fill the order, Brainard Rorison says, would test the capacity of their works for one month, and the reply, "Impossible; factory overloaded," was reluctantly sent.—*Indianapolis Daily Journal.*

Senator Sawyer's Plan.—A dispatch of Dec. 20 from Oshkosh says: When asked yesterday whether he he was in favor of the postal-telegraph scheme "Senator Sawyer said he would favor a bill which had been before the committee one and three years ago. That was that the Postmaster General advertise for proposals to do government telegraphing and all other business offered at a price not to exceed twenty cents for twenty words, including the address and signature, for 1,000 miles and under; twenty-five cents for distances between 1,000 and 1,250 miles, and not over fifty cents for twenty words for any greater distance in the United States, night messages at half prices, the government to furnish room in post-offices where wires run and other points it might designate, the company to furnish operators and the government to deliver the messages at free delivery cities for letter postage. If the government received no bids at the above prices then the Postmaster General would be instructed to advertise for proposals for the purchase of all lines in the country, and report the bids to the next Congress. This plan, Senator Sawyer said, would be similar to that adopted by the government in the operation of the mail service."

THE TELEPHONE.

The Big Telephone Case.—The opinion is becoming more and more prevalent in Washington that the delay in the rendering of the Supreme Court decision in the telephone suit augurs ill to the Bell patent. There appears no good ground for the belief, but there can be no doubt that it is held very generally. One would think that sufficient reason for the delay of the court could be found in the bulkiness of the matter to be waded through.

Output of Bell Instruments.—The output of telephones by the Bell Company for the month and year ended Dec. 20, is appended with comparisons :

Month Dec. 20.	1887.	1886.	Increase
Gross output	3,486	3,946	*460
Returned	2,094	1,686	408
Net output	1,392	2,260	*868
Since Dec. 20.	1886-87.	1885-86.	
Gross output	52,156	42,306	9,850
Returned	26,789	19,924	6,865
Net output	25,367	22,382	2,985

*Decrease.

This makes the number of telephone instruments in the hands of licensees Dec. 20, 1887, about 378,885, against 353,518 in 1886, 330,040 in 1885, 325,574 in 1884, 298,580 in 1883, and 237,728 in 1882. The gain in 1886 over 1885 was 23,478.

THE ELECTRIC LIGHT.

Seward, Neb., is to have an electric light plant.

Chambersburg, N. J., has before it an offer of 16 arc lights for $3,000 a year.

Greenville, S. C.—Asbury & Sons will add a Brush plant to their gas works.

Brenham, Tex.—It is understood that an electric light plant is to be put in at Brenham.

Newark, N. J.—The Newark Lighting Company has been granted permission to bury its wires.

Louisville, Ky.—It is stated that the Gaynor Electric Supply Company is about to double its works.

Burlington, N. J.—The proposals for the electric lighting plant for Burlington will be opened Jan. 3.

West Point, Ga.—The West Point Manufacturing Company is to put an electric light plant in its new cotton mill.

Alton, Ill.—The rate obtained by the Alton Gas and Electric Light Company for its arcs is $100 per lamp per year.

Willimantic, Conn.—The Natchaug Silk Company, Willimantic, is putting electric lights into its weaving room.

Chetopa, Kan.—An Edison electric light plant of 1000 16-candle power lamps has been installed at Chetopa, Kan.

Red Bank, N. J.—The new plant for the above place is to be put in by the Red Bank Electrical Illuminating Company.

Peterboro, N. H.—The Noone Brothers have put an electric light plant in their woolen mill at the South Village, Peterboro.

Johnson City, Tenn.—Mr. H. H. Carson has in hand negotiations for putting in a Thomson-Houston plant at Johnson City.

Waxahachie, Tex.—A company is being organized for electric lighting at Waxahachie. Messrs. Grace & Templeton are interested.

Yarmouth, N. H.—The *Daily Union* says: Yarmouth will be furnished with 16 candle power incandescent lights at three cents per light each night. Three hundred lights are subscribed for.

Sioux City, Ia.—The Sioux City Light, Heat and Power Company has been incorporated by E. MacMillin and others, with a capital stock of $100,000.

Baltimore, Md.—A company is to be formed by W. Wiesner, J. F. Wiesner, W. Mitchell and C. Kohlkepp to put in an electric light plant at Highlandtown.

Austin, Tex.—The Capitol Water, Light, Heat and Power Company, of Austin, has been incorporated with a capital stock of $300,000, by James Holmes and others.

Waterville, Me.—The Lewiston Machine Company shipped Thursday a pulley weighing 3,200 pounds, to be used for the Electric Light Company at Waterville.—*Mfrs.' Gaz.*

Rutland, Vt.—The Rutland Electric Company has raised all but $1,800 of its additional $25,000, and will proceed at once to increase its works to keep pace with the growing demand for light.

Sumter, S. C.—The Sumter Water-Works Company, with a capital stock of $50,000, has been incorporated by the Jeter & Boardman Water and Gas Association, of Macon, Ga. The privilege includes an electric light plant.

Montgomery, Ala.—The Montgomery Electric Light and Power Company has been reorganized. It has contracted to light the whole city, and is to put in $25,000 of new apparatus. Mr. B. Dunham is President and Mr. J. C. Verden Secretary and Treasurer.

Holyoke, Mass.—The Holyoke Electric Light Company have made still another increase in their system (the Schuyler) and are now running some 350 arc lights and the people are crying for more. This is certainly a very strong evidence of the progress of electric lighting. The thing most to be desired seems to be "more light."

New York.—The Mt. Morris Electric Light Co., of New York, which secured a portion of the city for lighting, has purchased of the new Schuyler Company, of Middletown, Ct., a 200-light plant as a starter, which number they propose to increase to fifteen hundred lights within a short time. The first 200 lights are to be started immediatel y.

Boston's Old South Church.—The ruthless spirit of the age has invaded the Old South Church, Boston, whose spire will soon be crowned with a cluster of electric lights. This would be regarded as sacrilege by the old timers. In their opinion the light from the open Bible on the pulpit was enough for any church.—*N. Y. Tribune.*

National Electric Light Association.—Mr. W. H. Harding, the secretary of the association, has issued the following notice: The annual meeting of the National Electric Light Association will be held at the Monongahela House, Pittsburgh, Pa., Feb. 21, 22 and 23, at eleven o'clock. Members desiring rooms will please notify S. A. Duncan, chairman executive committee, care of Alleghany County Light Company, Pittsburgh, Pa.

On the Toboggan Slide.—The new toboggan slides at Fleetwood Park are most brilliantly and effectively lighted by a round hundred arc lights of the Thomson Houston system, the plant having been installed by the ubiquitous and ever active Mr. J. J. Moore, for the New York Lighting Company. The New York *Herald* goes into raptures over the "steady, stainless glow" of the lights: "It was a weird, a superbly splendid picture. Wintry old Fleetwood had in an instant been converted into a dazzling fairyland, and all beyond it and around it was but darkness and nothingness. The interior of the club-house and of the grand stand were also flooded with light and their windows were ablaze. The toboggan tracks looked like long and brightly burnished ribbons of silver. The fun grew fast and faster and a musical band tried in vain to keep up with its pace."

Lighting the Hoosac Tunnel.—A telegram of Dec. 24, from North Adams, Mass., gives further details as follows: "The Fitchburg Railroad has decided to erect a permanent brick electric light station at the west portal of the Hoosac tunnel, of 150 horse-power. The engine is being built at Fitchburg to furnish power for driving three Westinghouse alternating dynamos for lighting the tunnel. Trenches for wire conduits in the tunnel have been dug nearly two miles from the west portal, conduits have been laid and the wire strung nearly the same distance. At the east end another gang of workmen is pushing work rapidly toward the west, the gangs meeting in the tunnel. The work of hanging lamps requires considerable time, as holes have to be drilled for iron brackets placed on the sides of the tunnel. Lighting the great bore involves several novel problems in electric engineering. Preliminary experiments last summer showed that gas and smoke exerted a powerful corrosive effect on common appliances, making a chemical action to contend against with dampness. Metal sockets usually employed with incandescent burners cannot be adopted, and extreme pains must be taken with connections. It is expected the system will be ready in a few weeks. Steam pipes will also be hung 500 feet in from each portal to protect the brick-work from frost.

APPLICATIONS OF POWER.

An Electric Railway Manifesto.—The Overhead Conductor Electric Railway Company, of which George Westinghouse, Jr., is president, have issued an illustrated pamphlet on the subject of propelling cars by electricity. In their introduction they say: "The results of a comparatively short experience in the use of electricity as a motor for surface railway cars, have been such as to demonstrate beyond question its immense superiority for this purpose over any other known method of applying power. Every consideration of efficiency, convenience and economy, not to speak of humanity, urges the substitution of mechanical for animal power upon the numerous street railway lines of this country, at the earliest practical moment, and in the contest for superiority in the various more or less successful methods of applying mechanical power to this purpose, such as the steam locomotive, the traction cable, and the electric motor, the last named is at the present moment generally admitted by those most competent to judge to be distinctly in advance of competitors."

PERSONALS.

Mr. John Pender has, we learn on good authority, just been created a Knight Commander of the Order of St. Michael and St. George for his distinguished public services.

Dr. Norvin Green, and the way he and his associates spend their working days at the Western Union headquarters, were well described in an article in the *Mail and Express* last week.

Dr. P. H. Van der Weyde, the well-known electrician, has lost a gold medal given him at Amsterdam, Holland, in 1846, for the best text-book on physics and mechanics. All will wish him a speedy recovery of the medal.

Mr. W. N. Gray, electrical engineer, of Cincinnati, Ohio, has been appointed a Commissioner of the Centennial Exposition to be held in that city this year. He will have the planning and supervision of the lighting of the buildings, which will be very extensive.

Prof. Balfour Stewart.—The death of Prof. Balfour Stewart, of Owens College, Manchester, occurred suddenly. He left Manchester in perfect health, to all appearances, for the purpose of spending the Christmas holidays with his family on his Irish property near Drogheda, and three days later news of his death reached Manchester.

Mr. John W. Mackay, president of the Commercial Cable Company, has, through Vice-President DeCastro and General Manager Ward, given notice that his Christmas present, for the third time, is an extra half month's salary to the company's whole staff. This gift aggregates $9,000 and is an unequivocal sign of the large-heartedness of the donor as well as of his appreciation of a first-class body of experts and employés.

Mr. A. B. Uline, of Albany, was a close, personal friend of the late Secretary Manning. The acquaintance dated back long before Mr. Uline's telephonic career, but was maintained throughout with the same warmth and pleasantness. Mr. Uline, who was interviewed recently on the subject in Albany, and contributed a number of interesting reminiscences of the deceased statesman, says that he was always certain, in him, of at least one backer, in whatever he undertook.

Mr. Willard E. Case is to present a paper before the American Institute of Electrical Engineers, on Tuesday, Jan. 10, on his recent important and interesting work in obtaining electrical energy directly from coal and heat in the chemical battery. Some of Mr. Case's earlier work has already received the attention of the Royal Society, and there is no doubt that the present paper will be very valuable. The meeting will be held at 8 P. M., at the house of the American Society of Civil Engineers, 127 E. 23d street.

Mr. Frank C. Mason, the popular superintendent of police telegraphs, is just finishing his fourth year in that position, and to celebrate the ending of his second term last week invited several other attachés of the department to dine at Morello's, Twenty-ninth street and Fifth avenue, New York. Besides Mr. Mason, who sat at the head of the table, there were present: Deputy Commissioner Francis L. Dallon; Operators, James Campbell, William Gear, James Keenan, Thomas Cornell, John Maloy; Linemen, Augustine Manee and Peter Higgins, and Clerk Alexander Guise. The menu was Morello's best, and was relished as only faithful and industrious men can relish a dinner served during a brief period of absolute relaxation from laborious work. —*Brooklyn Union.*

MISCELLANEOUS NOTES.

Flint Glass Workers on Strike.—There is at present an almost entire suspension of flint glass manufacture in this country. The industry employs about 15,000 operatives, and includes several branches pertaining to electrical work. The dispute is over rules and the scale.

"An Authority on all Electric Subjects."—THE ELECTRICAL WORLD, of New York, has issued in convenient pamphlet form a brief history or outline of the growth and development since its establishment about fourteen years ago. THE ELECTRICAL WORLD enjoys the distinction of being an authority on all electric subjects, and this it has acquired by energy and perseverance.—*Industrial World.*

Bad Gas Explosions.—New York city saw two bad gas explosions on the last night of the year. By the first explosion, the engine house of the Equitable Gas Company, First avenue and Forty-second street, was reduced to ruins, and the effect was more or less felt all over the city. It is alleged that nitro-glycerine was used by some malicious person, as gas could not have done so much damage. The other explosion, or series of three explosions, occurred at a lager bier saloon on Third avenue, injuring eight persons.

BUSINESS NOTICES.

Hine & Robertson, 45 Cortlandt st., N. Y., offer special inducements to electric light superintendents and engineers to use "Eureka" packing and other specialties. It will pay to address them.

The "Wanted" advertisement on page opposite patents, in this issue, signed "Confidential," deserves the attention of those competent to fill the position, which is an exceedingly desirable one for the right man, but he must be strictly first-class.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DECEMBER 27, 1887.

375,328. Commutator or Electric Circuit Breaker; C. D. Baker, Chicago, Ill. Application filed Nov. 24, 1886. A series of wires of different lengths may be made to come in contact in any number with a movable contact piece.

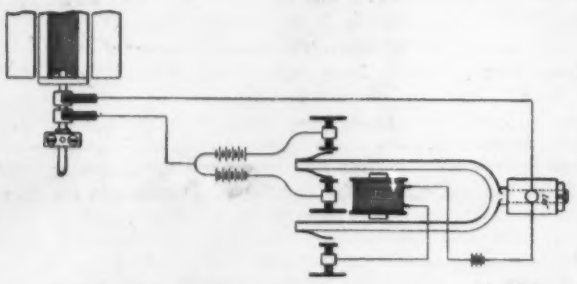
375,339. System of Synchronism for Telegraphy; G. A. Cassagnes, Paris, France. Application filed Aug. 30, 1887. An improvement on letters patent No. 368,931, whereby use is made of alternating current motors. See illustration.

375,346. Electrically-Propelled Vehicle; Stephen D. Field, Yonkers, N. Y. Application filed April 1, 1877. The floor of the car is on a plane lower than the axles of the motor and is supported in part by a curved girder.

375,392. Electric Meter; W. A. Stern. Allegheny City, Pa. Application filed June 18, 1887. The indicator is operated by the armature of two coils, one of which is in the main line and the second coil in parallel with the translating devices, and in circuit with a variable resistance device operated by the magnet.

375,390. Portable Electric Coal-Mining Machine; John B. Sneathen and Albert Michaels, Pittsburgh, and Moses A. Michaels, Allegheny, Pa. Application filed Dec. 31, 1886. This is a portable drill operated by electricity. It is made up of a horizontal bed-plate, a reciprocating drill mounted in suitable bearings thereon, an electric motor on the bed-plate and having a crank and pitman connection with the drill-bar, and a train of gearing from the motor to the drill-bar.

375,403. Automatic Rheostat and Contact Point; A. G. Waterhouse, Hartford, Conn., Assignor to the Waterhouse Electric and Manufacturing Company, of same place. Application filed Jan. 29, 1887. Certain mechanical means of pro-



375,339. SYNCHRONOUS TELEGRAPHY.

ducing a rise and fall of a column of mercury is the first part of the invention, and the second part consists in a series of cells containing mercury, the contents of each cell forming contact with electrical conductors. The cells are arranged at different altitudes, and as the mercury rises or falls it makes contact with more or fewer cells.

375,408. Cal-electric Generator; E. G. Acheson, Pittsburgh, Pa. Application filed Aug. 26, 1887. For description see this issue, page 7.

375,414. System of Electric Gas-Lighting; W. H. Doering, Philadelphia, Pa. Application filed March 25, 1887. The object is to control the flow of gas with the use of a minimum amount of current. The arrangement is such that the maximum power of a magnet upon a polarized armature is utilized by the action of each pole of the magnet upon a distinctive and opposite pole of the armature, both for opening and closing the cock.

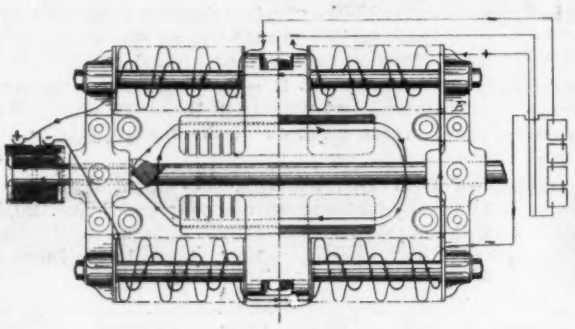
(1) 375,441. Galvanic Battery; (2) 375,442. Hotel Signal; H. B. Cox, Cincinnati, O. Applications filed respectively May 5 and 21, 1887. (1) For description see page —, this issue. (2) By this device the hotel clerk can ring up any guest and continue the ringing until an answer is given. In case of fire or other danger the device may be arranged to continue ringing whether the guest rings an answer or not. This is accomplished by a circuit closer in the hotel office, which is controlled by the clerk.

375,456. Telephone; E. C. Newton, Little Rock, Ark. Application filed Feb. 24, 1887. Coils are placed on the end of a horseshoe magnet and their armatures are separated and connected with the diaphraghm by levers which are elastically supported.

375,476. Electrical Cut-out Device; J. C. Chamberlain, New York, N. Y. Application filed June 29, 1887. An insulating block is provided with metallic barrels, through which pass connecting strips joining the wires at the extremities of the barrels.

375,542. Electrical Converter, Motor and Generator; R. Eickemeyer, Yonkers, N. Y. Application filed Aug. 10, 1887. The armature has a core of magnetic metal, with independent coils or windings thereon, a separate commutator for each of the coils, an exciting helix surrounding and directly polarizing the armature and a magnetic shell which incloses the helix form also a part of the invention.

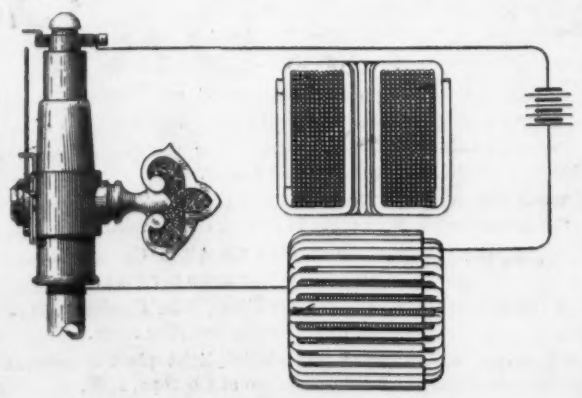
(1) 375,543. Electric Circuit Changing and Signaling Apparatus; (2) 375,544. Electro-magnetic Arresting and Releasing Mechanism; I. H. Farnham, Malden, Assignor to the American Bell Telephone Com-



375,676. ELECTRIC MOTOR.

pany, of Boston, Mass. Applications filed March 26, 1887. (1) The invention has been used with the village system of telephone exchange circuits patented Oct. 7, 1885, by E. T. Gilliland. The object of the invention is to provide convenient means whereby a distant station connecting with the village system by a single trunk line wire may automatically unite itself with any predetermined circuit of the system, simultaneously transferring both trunk and village lines from their normal connections or terminals to a connection with one another. (2) The invention comprises the combination with a clock-work mechanism having pins, cams, or projections at as many stopping places as may be desired, of means actuated by such pins for engaging the fan or fly of the mechanism. In this way the mechanism is arrested with great precision at the proper point and is also adapted to be easily started again when necessary.

(1) 375,559. Galvanic Battery; (2) 375,560. Electric Motor; (3) 375,561. Primary Battery; J. F. McLaughlin, Philadelphia, Pa. Applications filed respectively



375,614. SPARKER COIL FOR GAS LIGHTING.

May 5, Dec. 16, 1886, and Aug. 10, 1887. (1) The zinc element is in the form of a spiral and the carbon element in the form of plates, with space between them. This gives an increase of surface. (2) The field magnets are of the horseshoe type and are set at right angles to each other, and the armature is of the same construction. (3) The carbon and zinc elements are separated by a horizontal perforated diaphragm.

375,569. Automatic Cut-Out for Fire-Alarm Box Controllers; C. D. Rogers, Providence, R. I. Application filed May 11, 1887. The invention consists in the combination with the box controller having an electrically connected circuit-breaking device, of a cut-out box carrying electro-magnets, a pivoted lever carrying the armature of the magnets, mechanism adapted to be released by the action of the armature lever, and connections electrically uniting the box controller, local circuit and cut-out box.

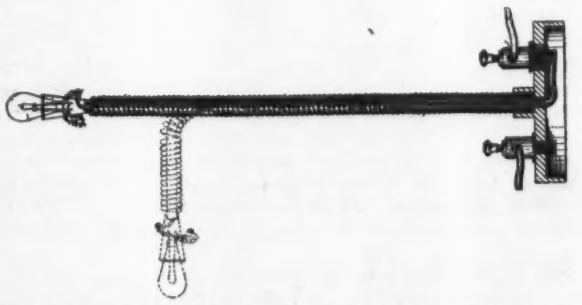
375,579. Apparatus for Recording and Reproducing Speech and Other Sounds; C. S. Tainter, Washington, D. C. Application filed July 7, 1887. A peculiar arrangement of flexible sound-conveying tubes in relation to the diaphragm, together with a tablet and special devices for making an efficient apparatus.

375,614. Sparker Coil for Gas Lighting; R. Eickemeyer, Yonkers, N. Y. Application filed Aug. 23, 1887. A sparker consisting of insulated wire in the sparking circuit, and magnetic metal which incloses the wire and affords a closed magnetic circuit during the passage of an electric current in the wire and facilitates a prompt electrical discharge. See illustration.

375,617. Electric Call Box; L. B. Firmal, Chicago, Ill. Application filed March 28, 1887. In boxes adapted to send in different alarms a different key is used for each alarm. When the key is used to unlock the outer door it at the same time puts the box in condition to send the particular kind of alarm which that key represents.

375,633. Underground Electric Conductor; D. C. James, Warren, Pa. Application filed March 29, 1887. The conductors are imbedded in a compound of rosin, pulverized glass and sulphur.

375,636. Fire Extinguisher and Alarm; C. E. Kells, Jr., New Orleans, La. Application filed Nov. 6, 1886. On the occasion of a fire an acid bottle is broken by a magnet



375,702. FLEXIBLE LIGHT STANDARD CONDUCTOR.

armature. The acid generates the extinguishing gas. A thermostat and push button are in circuit with the magnet, so that on the operation of either the bottle will be broken.

375,676. Motor; E. Julien, Brussels, Belgium, Assignor to the Julien Electric Company, of New York, N. Y. Application filed Nov. 30, 1886. The armature is made up of toothed rings supported on a wooden spider, and end pieces are provided having suitable air openings. There is also an arrangement of coils and connections with respect to the commutator, which is novel. See illustration.

375,685. Double Spring Loop Key and Circuit for Multiple Switch-Boards; C. E. Scribner, Chicago, Assignor to the Western Electric Co., of same place. Application filed May 12, 1885. By this device a switchman may switch his telephone into the circuit of any single telephone line or loop his telephone into the pair of cords connecting two subscribers' lines.

375,697. Tension Device for Winding Electro-magnets; J. W. Easton, New York, N. Y. Application filed March 16, 1887. A motor is used to exert its force to turn the reel in a direction contrary to that which the reel turns to give off the wire.

375,702. Flexible Standard and Conductor for Electric Lights; E. C. Fasoldt, Albany, N. Y., Assignor of one-half to O. W. Meyrowitz, same place. Application filed April 4, 1885. A soft wire covered with insulating material is wound spirally with a conducting wire, which will permit of easy bending. See illustration.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.